ELECTRICAL REVIEW

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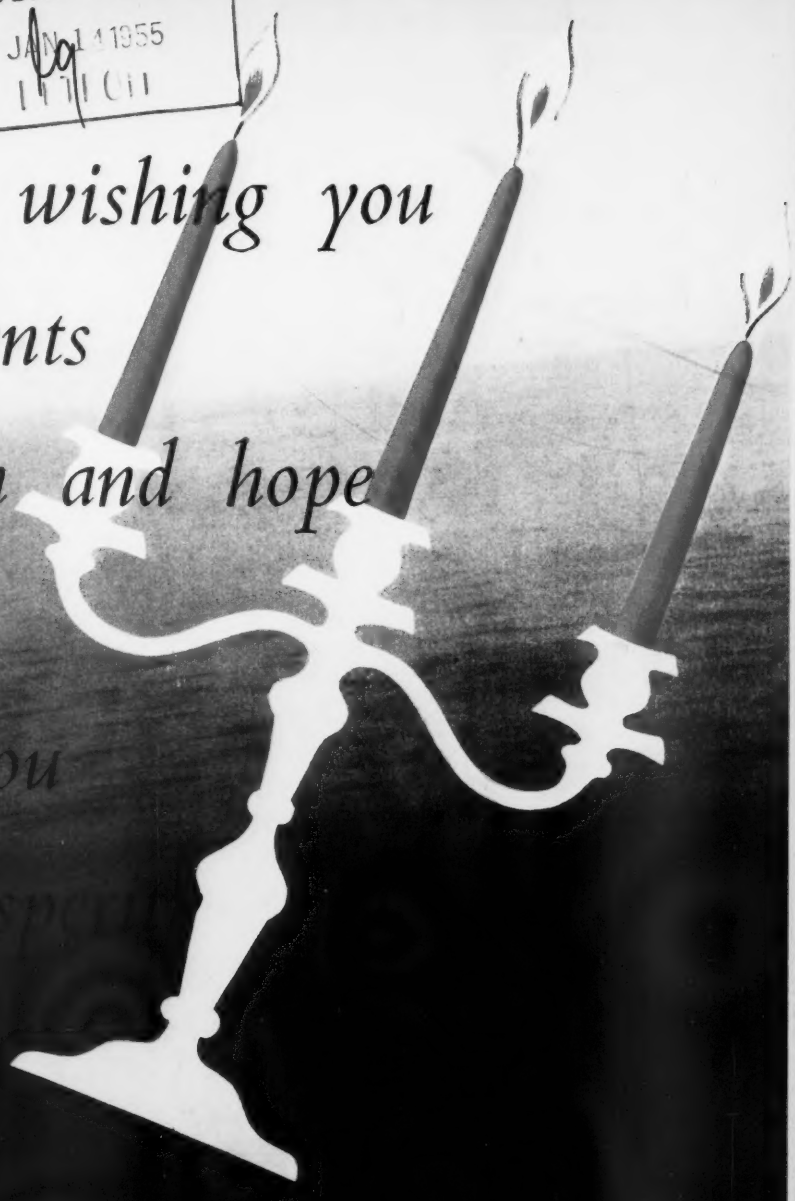
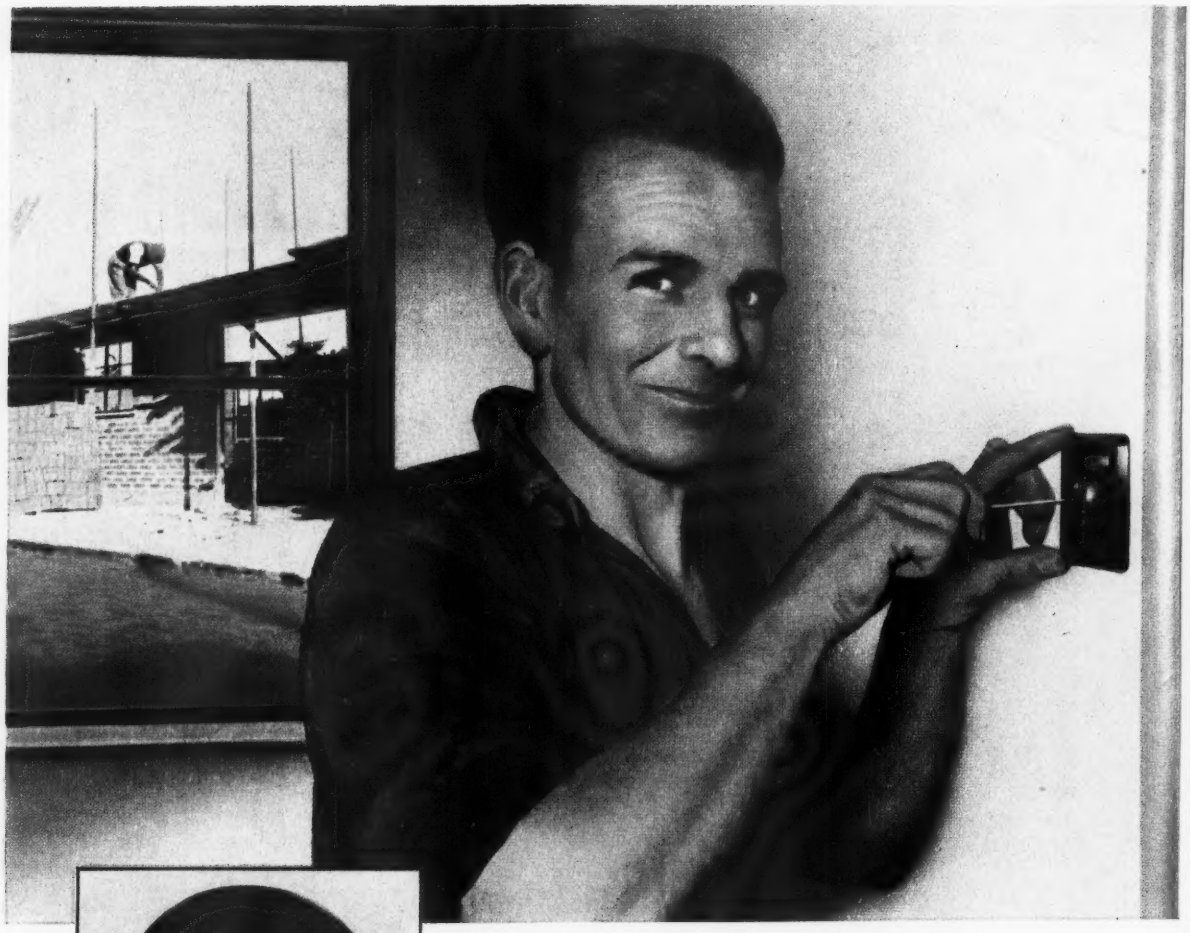
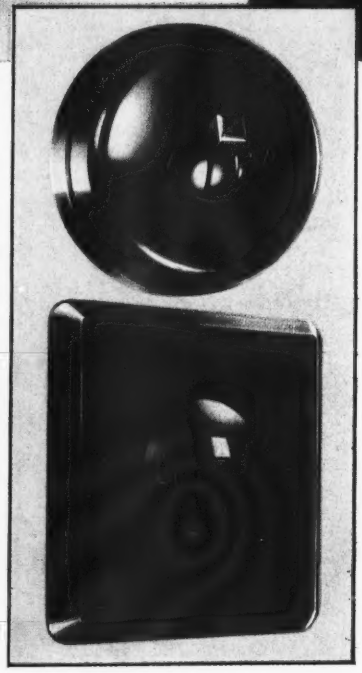
LITCH



We join in wishing you the compliments of the season and hope that 1955 will bring you increased prosperity

GEORGE ELLISON LIMITED · TUFNOL LIMITED
ALFRED ELLISON LIMITED · BIRMINGHAM





My point of view . . .

. . . is that the Avon Range of A.C. Switches has been designed with considerable thought. For instance when fitted in their plaster depth boxes they have a simple method of adjusting the switch depth whilst the switch is in position.

Points like these mean a great deal to chaps like me. They also show that apart from producing a jolly good switch at a very competitive price Ediswan Designers have given quite a lot of thought to making them simple to install.

Publication CE.1693A gives full details of the Avon range.

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RANGE OF ELECTRICAL ACCESSORIES

A catalogue and price list of the complete range of Ediswan electrical accessories is available on request.

E32

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155 Charing Cross Rd., London, W.C.2, and branches.

Member of the A.E.I. Group of Companies

Model 8 UNIVERSAL AVOMETER

20,000 ohms per volt plus AUTOMATIC Overload Protection

Produced in response to a demand for a high sensitivity version of the world-famous Universal AvoMeter, this model incorporates the traditional design features of its predecessors, so highly valued for simplicity of operation and compact portability.

It has a sensitivity of 20,000 ohms per volt on all D.C. voltage ranges and 1,000 ohms per volt on A.C. ranges from 100V. upwards. A decibel scale is provided for audio frequency tests. In addition, a press button has been incorporated which reverses the direction of current through the moving coil, and thus obviates the inconvenience of changing over test leads when the current direction reverses. It also simplifies the testing of potentials, both positive and negative, about a common reference point. A wide range of resistance measurements can be made using internal batteries, separate zero adjustment being provided for each range.

It is of importance to note that this model incorporates the "AVO" automatic cut-out for protection against inadvertent overloads.

Size 8⅛" × 7¼" × 4½"
Weight 6¼ lbs. (including leads)

£23 : 10s.

For your Valve Characteristic Meter or Valve Tester

Owing to the very large number of valves which have been issued within the last two years, no further amendments will be issued for the original "AVO" Valve Testing Manual. A new, completely revised and fully up-to-date Valve Data Manual is now available from the Company at 15/- post free.

D.C. VOLTAGE	D.C. CURRENT	A.C. VOLTAGE	A.C. CURRENT	RESISTANCE
2·5V.	50μA.	2·5V.	100mA.	*First indication 0.5Ω.*
10V.	250μA.	10V.	1A.	*Maximum indication 20MΩ.*
25V.	1mA.	25V.	2·5A.	0 –2,000Ω — using internal batteries.
100V.	10mA.	100V.	10A.	0—200,000Ω — using internal batteries.
250V.	100mA.	250V.	—	0—20MΩ — using internal batteries.
1,000V.	1A.	1,000V.	—	
2,500V.	10A	2,500V.	—	0—200MΩ — using external batteries.

THE AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO. LTD.
WINDER HOUSE · DOUGLAS STREET · LONDON S.W.1 *Telephone* VICtoria 3404—9

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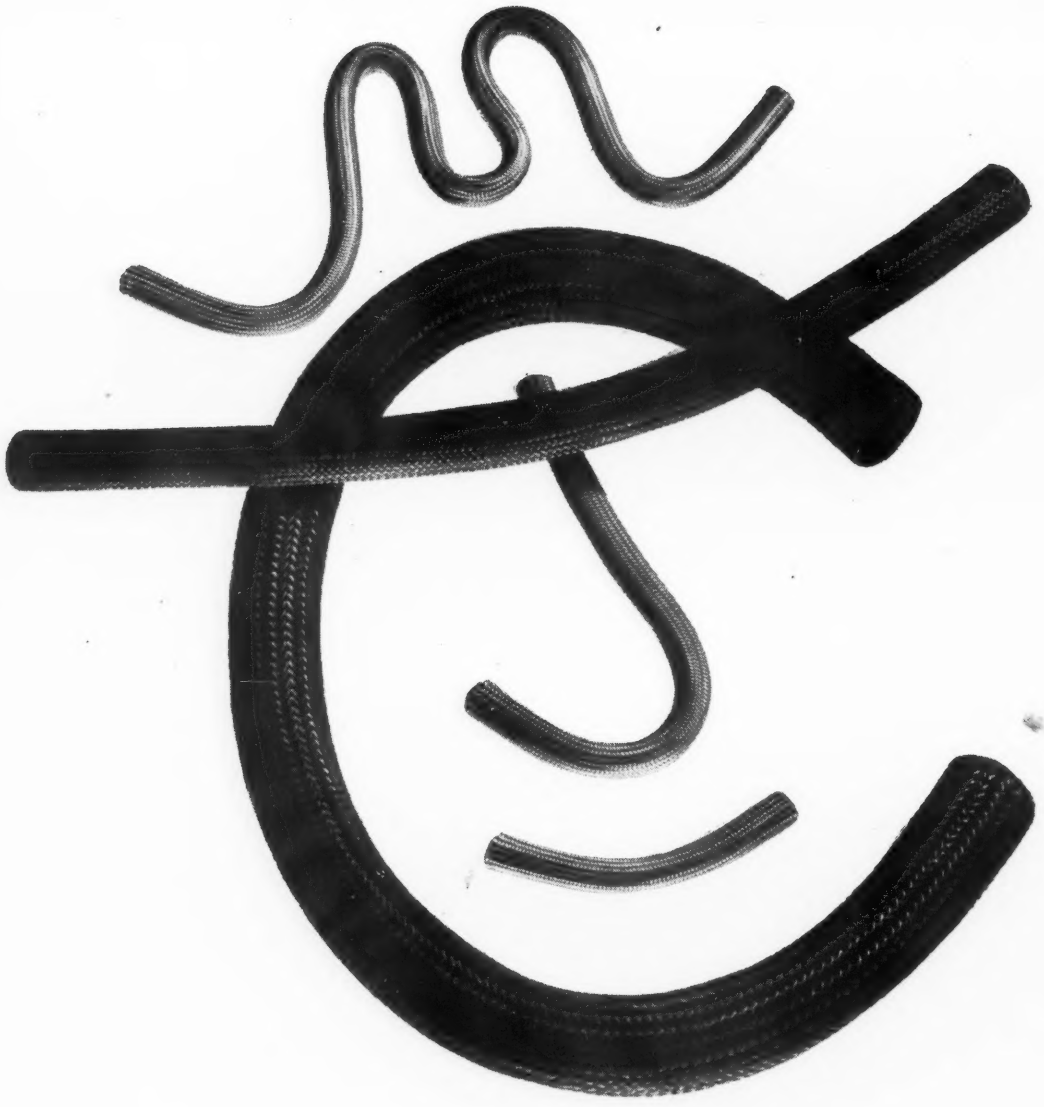

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Vidaflex sleeving is braided from Fibreglass ' E-glass ' yarn. It is therefore intrinsically heat-resisting, rot-proof and unaffected by climatic conditions. The sleevings, which are non-fraying, can be supplied unimpregnated or impregnated with silicone or other varnishes of high dielectric strength. They come in a range of sizes from 0.5 mm. to 30 mm. diameter, and in continuous or 1 yard lengths. Vidaflex is made by

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costs

The simplicity and cheapness of AZOFLEX are quite startling. With the Model 42/63 Mark II Combine Printing and Developing Machine illustrated here, for example, one *unskilled* operator need only feed originals and copying material into the machine in order to produce a steady output of finished prints, dried, flat and ready for trimming and collating. Exposing, developing and print delivery are completely synchronized.

come

With the AZOFLEX method, money is saved because not only does it eliminate the need for specialist operators, but neither darkroom accommodation nor water and drainage services are required, and the materials themselves are inexpensive. AZOFLEX also cuts costs by speeding up output and by giving copies of greatly improved quality even from poor originals.

down

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For descriptive literature about AZOFLEX machines and materials, please apply to Ilford Limited, Azoflex Department AZ3H, 104 High Holborn, London, W.C.1 (Telephone: HOLborn 3401). Demonstrations of the Azoflex process can be seen at this address and also, by appointment, at Ilford Limited, 22 Lloyd Street, Manchester 2 (Telephone: Deansgate 4233) and in other principal cities.

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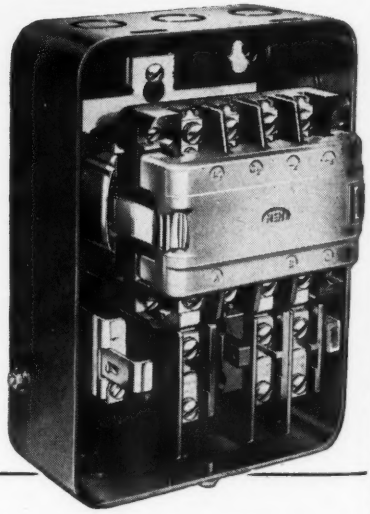

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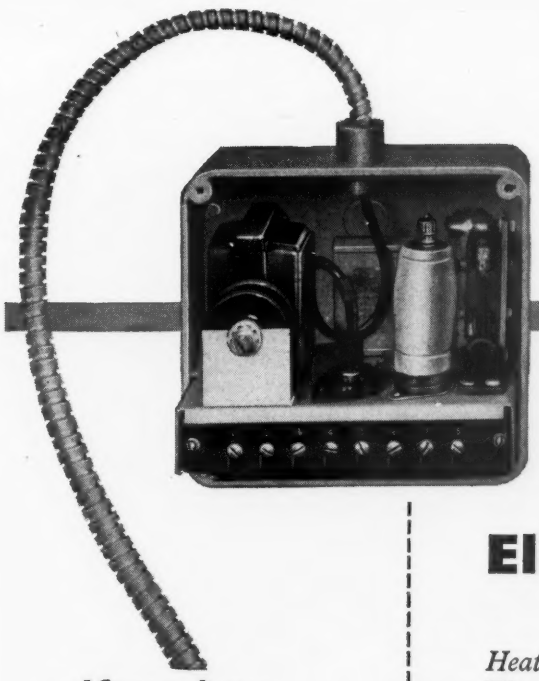

B T-H

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Heat rays effect on/off switching of electric power. The use of infra-red radiation for automatic control has a wide field of application in both light and heavy industries. British Thomson-Houston offer unrivalled design and manufacturing facilities for the production of both standard and special equipments, for duties at temperatures ranging from the very highest down to below 100°C.

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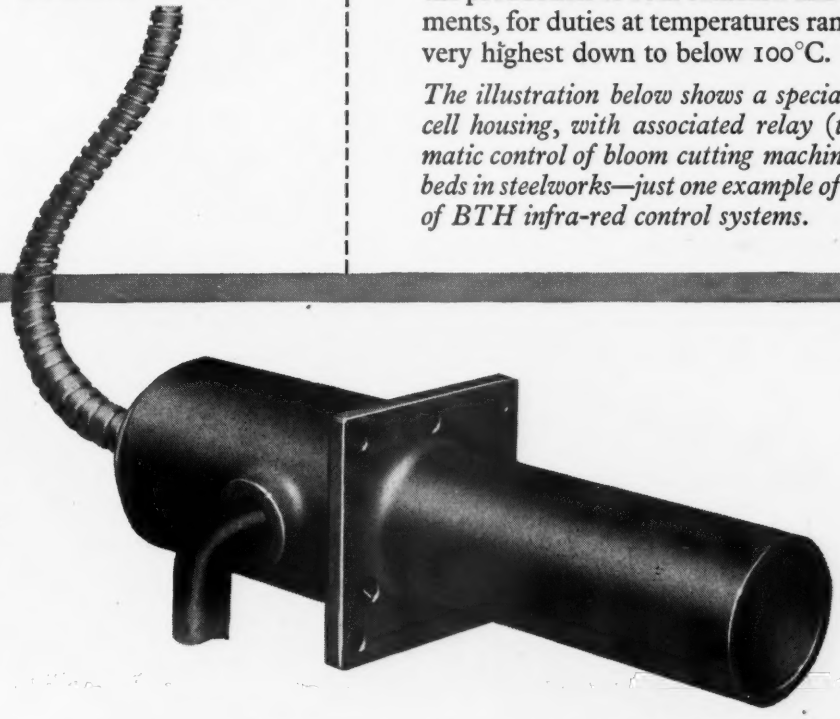
If you have a control problem— consult BTH



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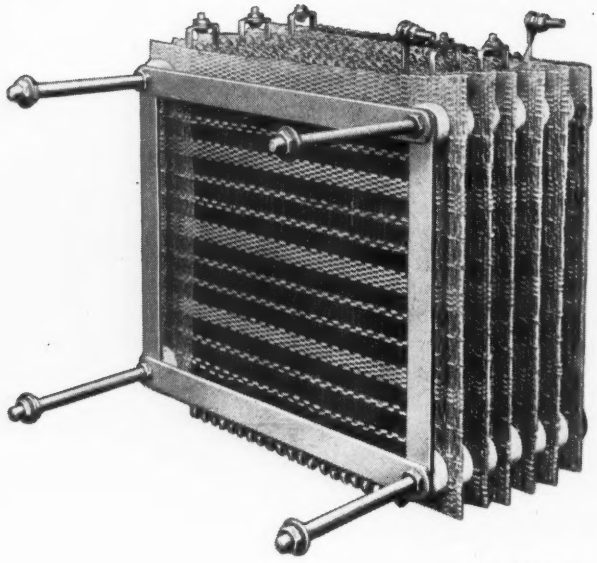

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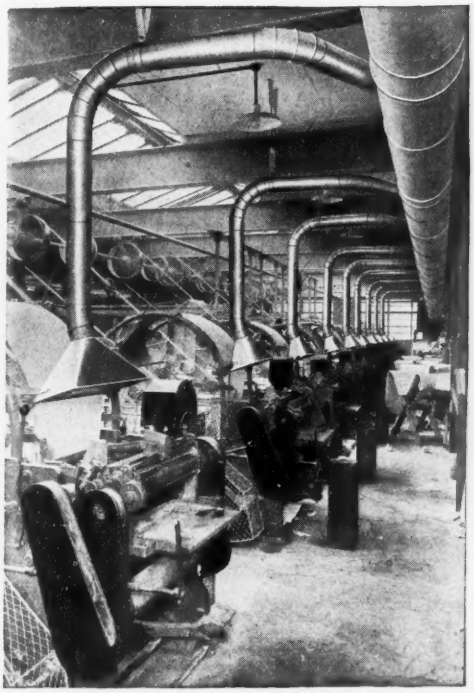
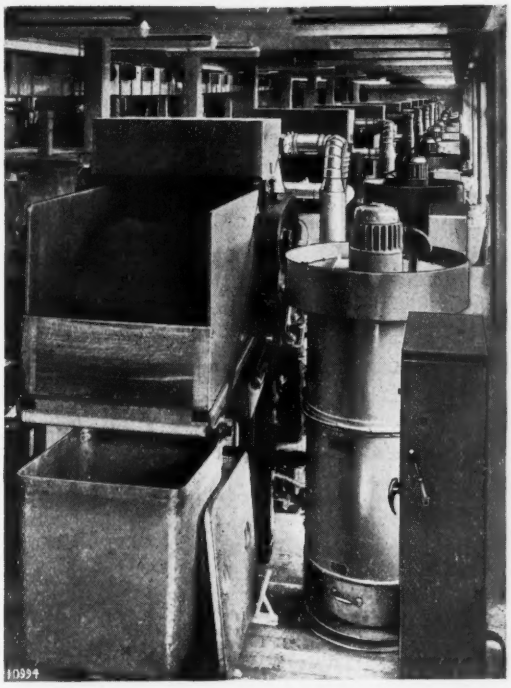
IS DUST YOUR PROBLEM ?





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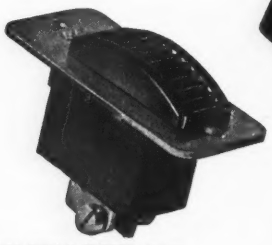
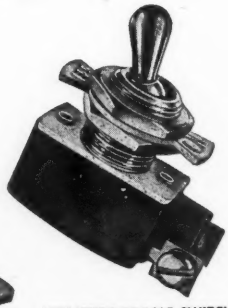


SLIDE THUMB SWITCH—S.645
3 amp., 250 volt



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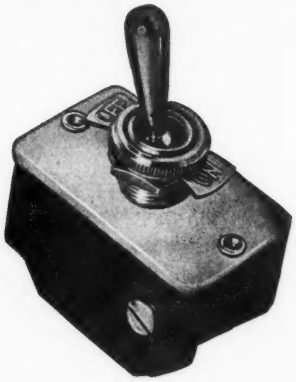

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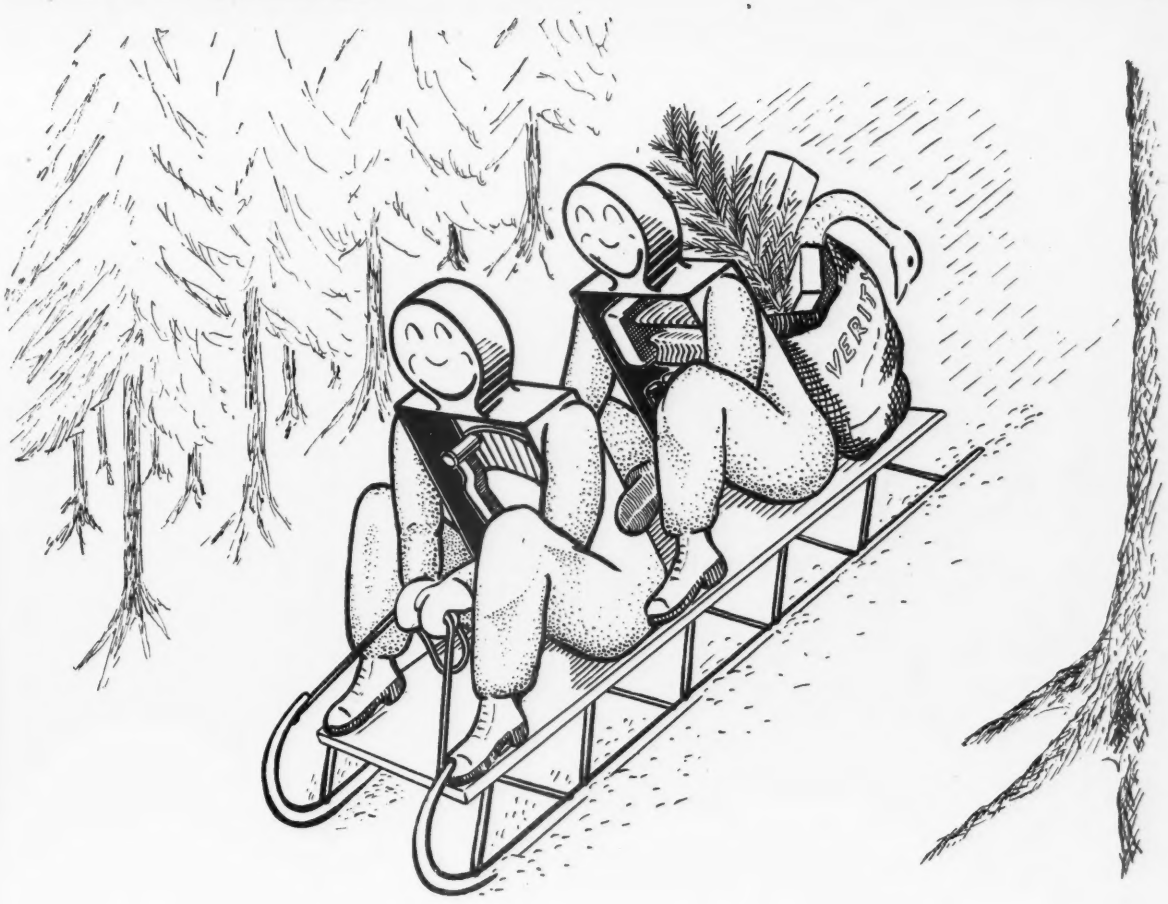

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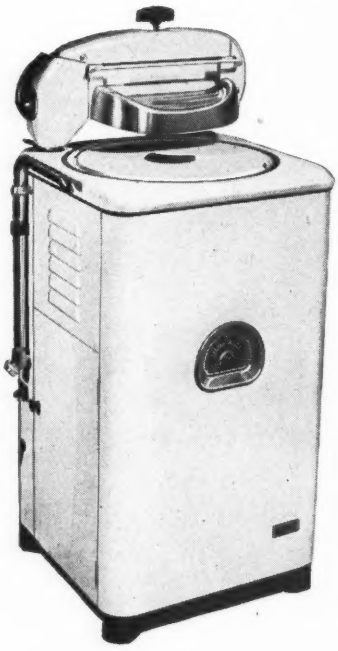

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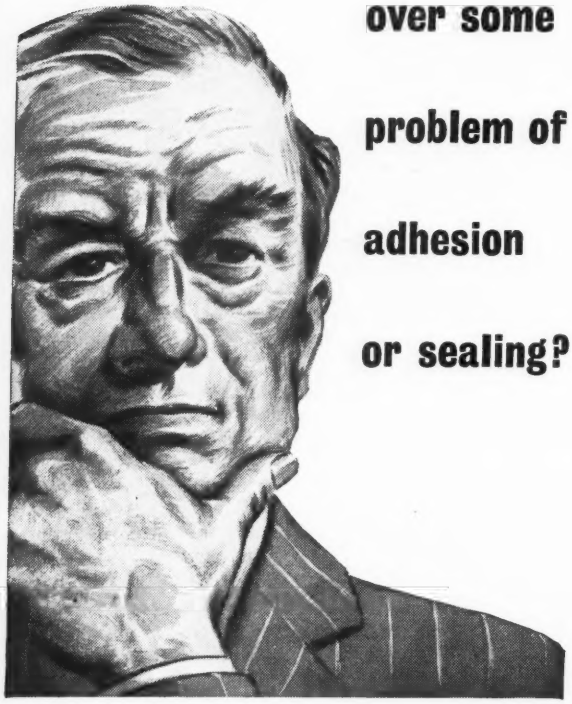

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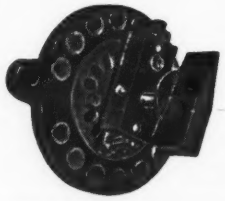

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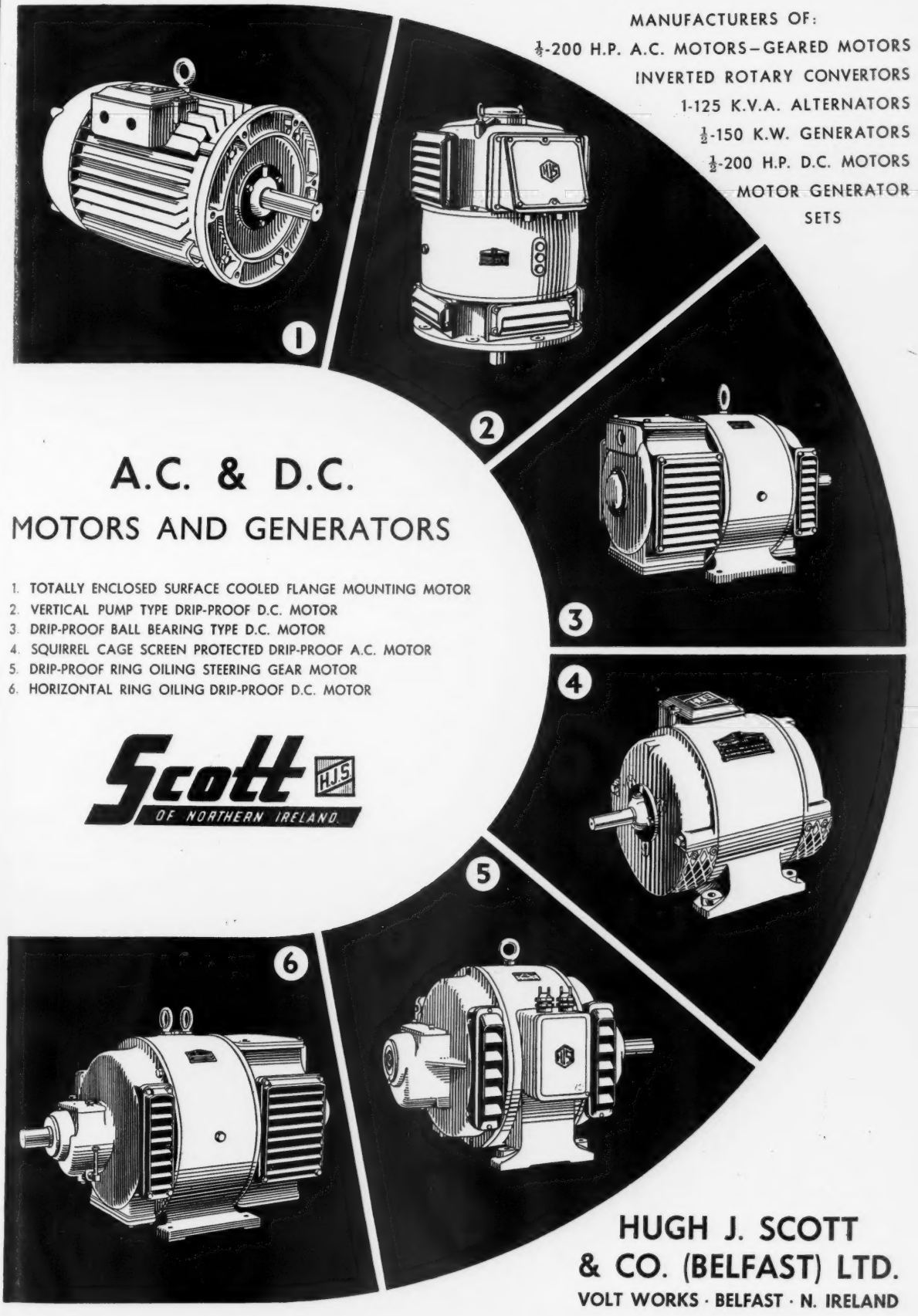

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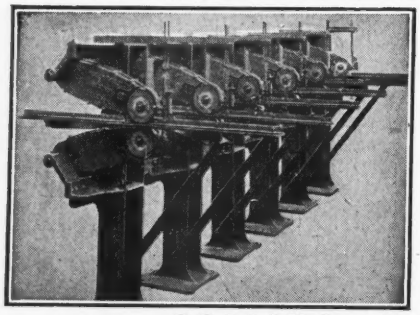

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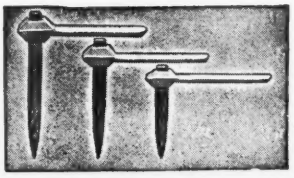

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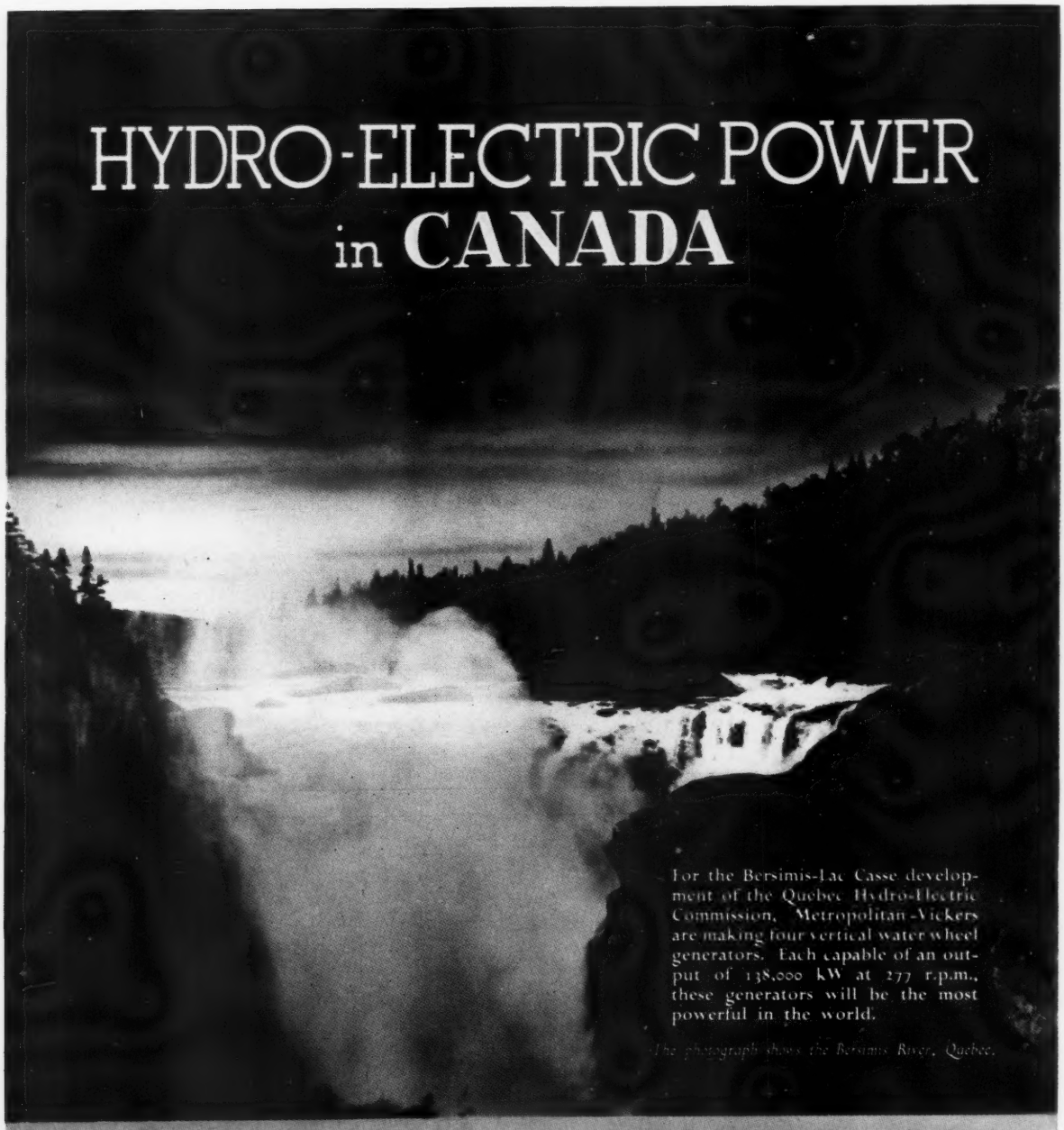

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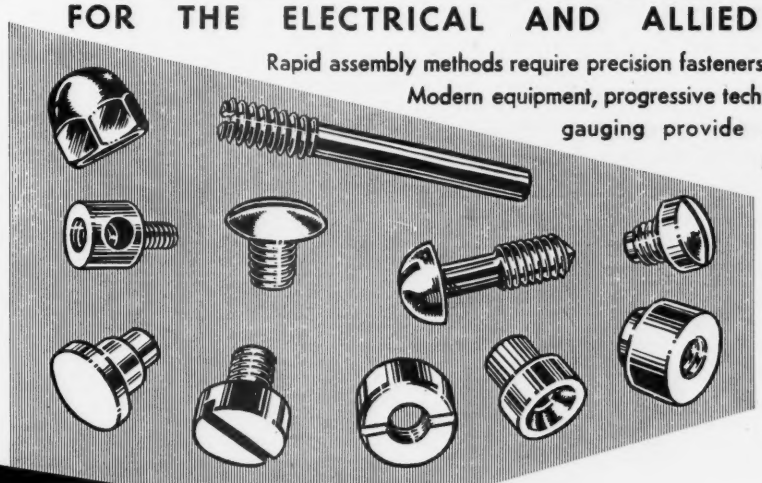

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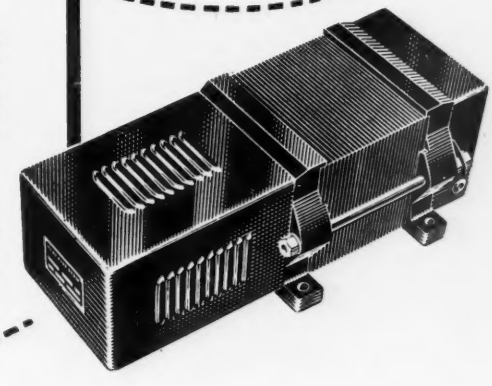

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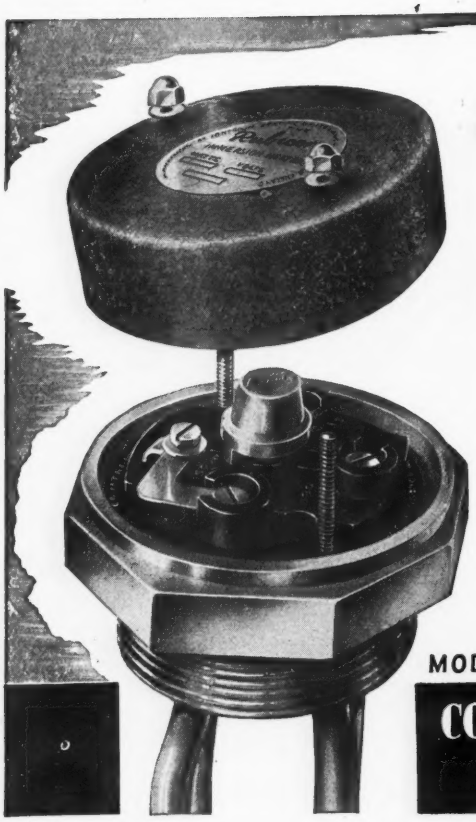

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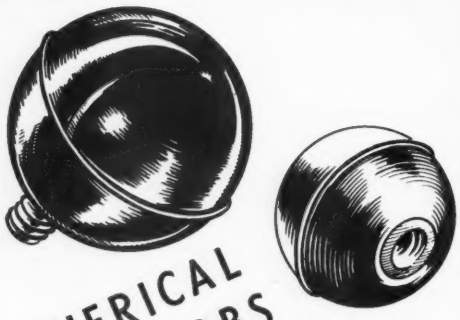

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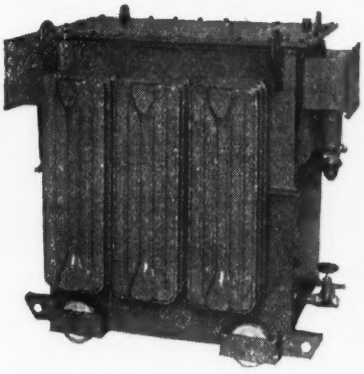

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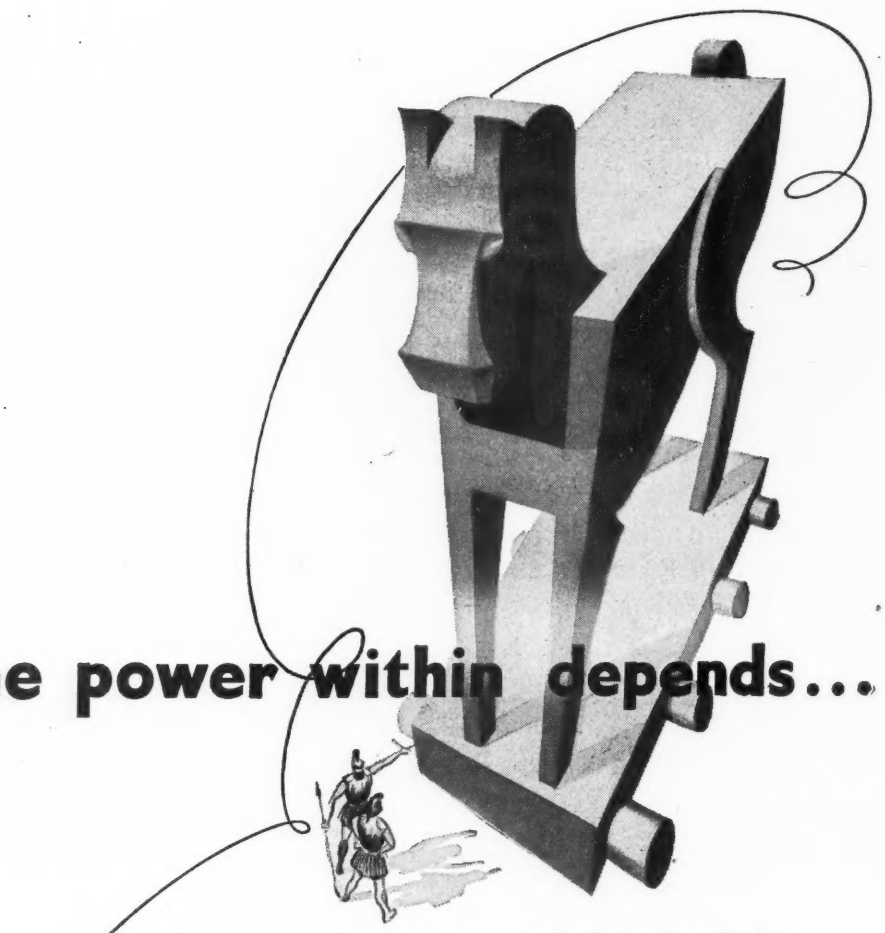

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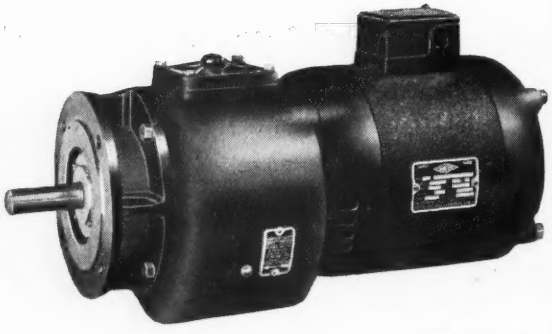

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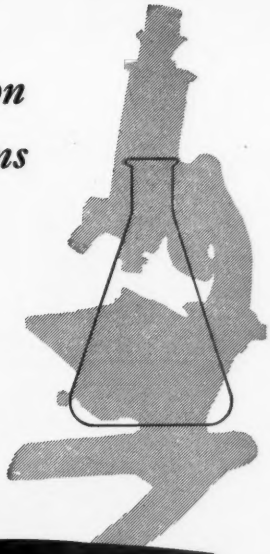

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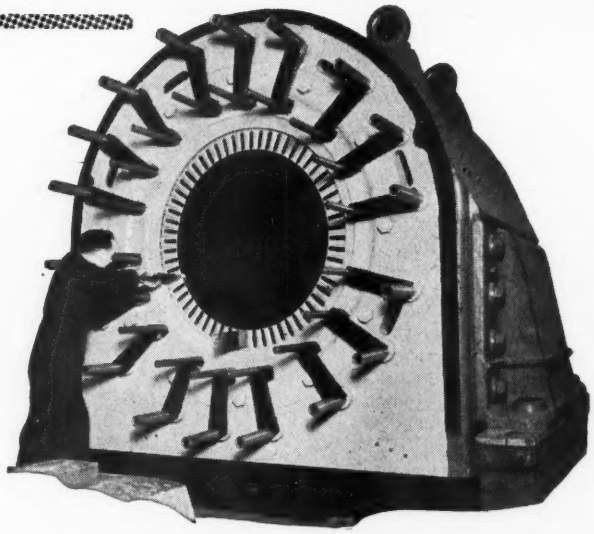

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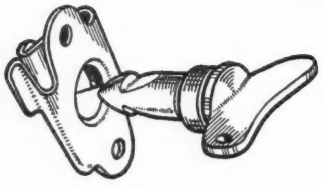

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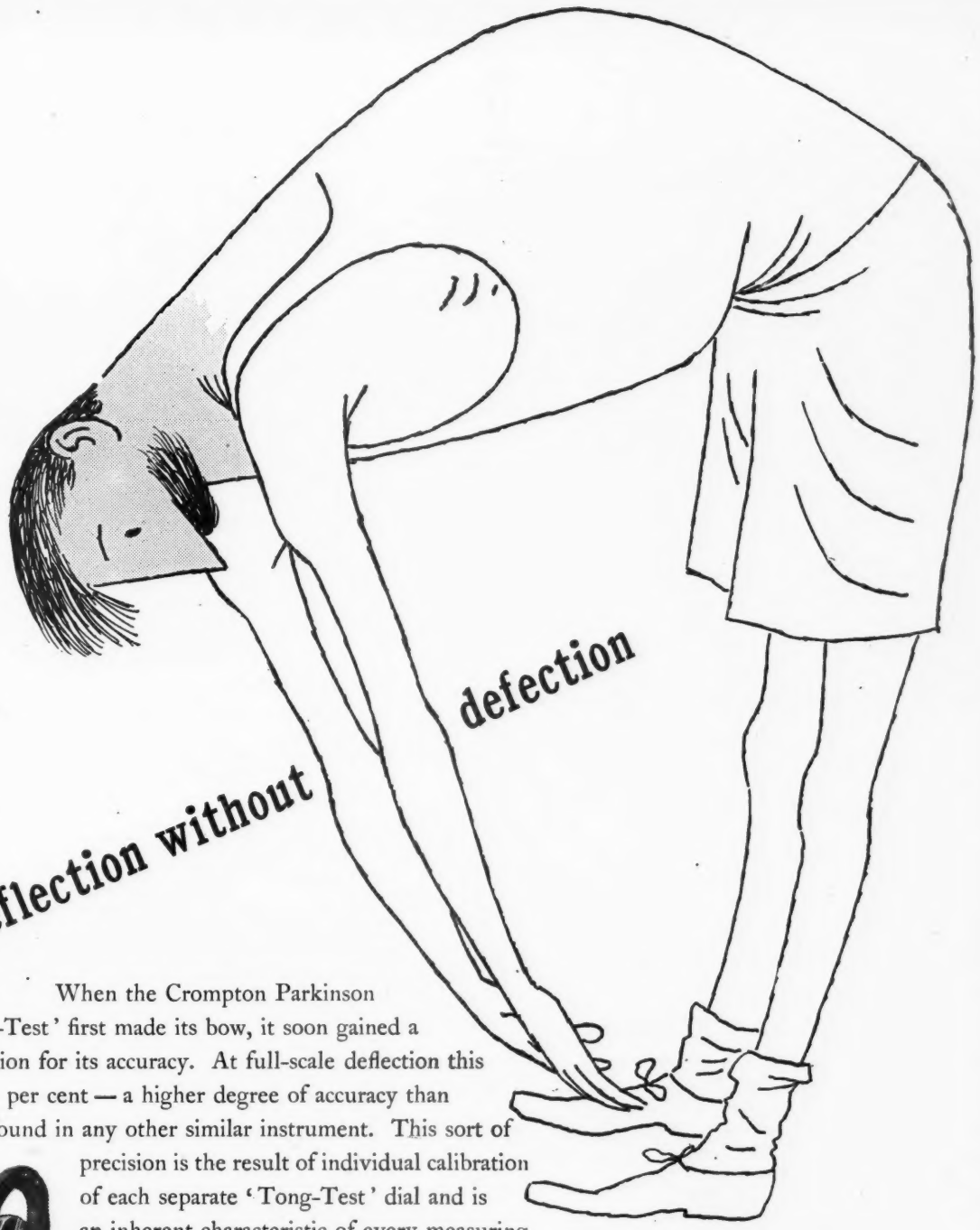

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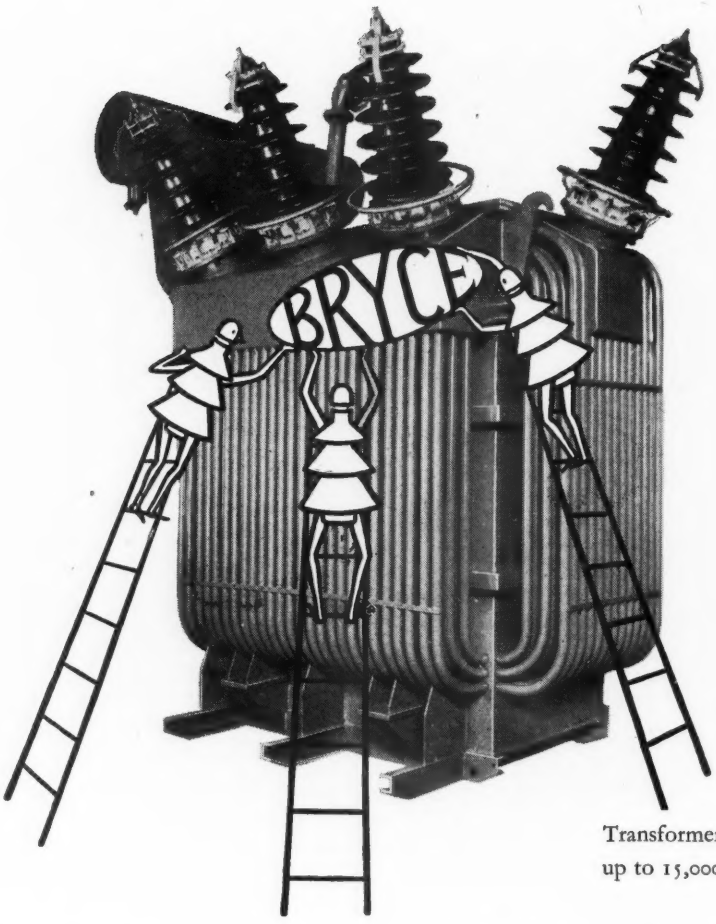

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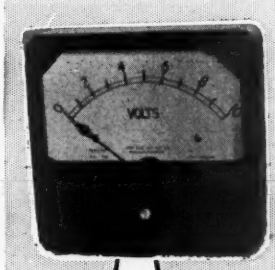

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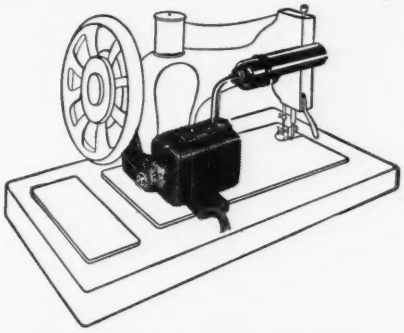

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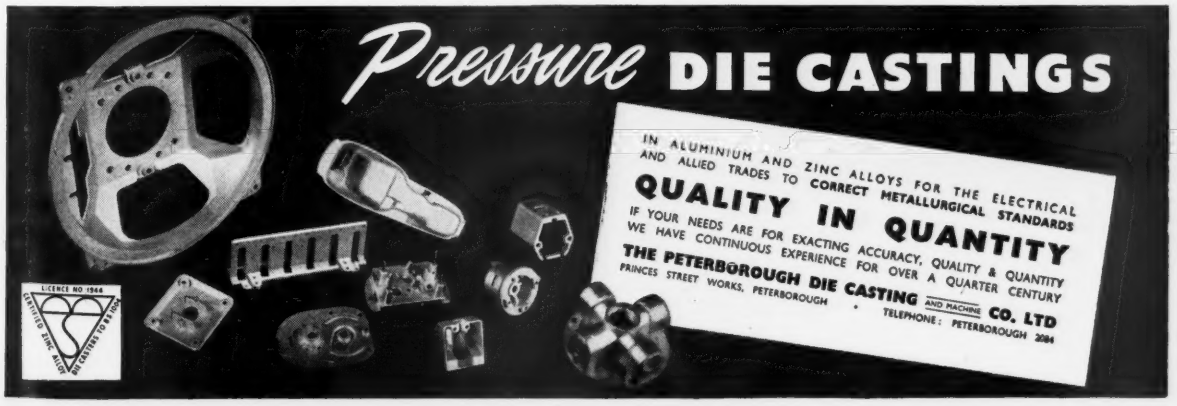
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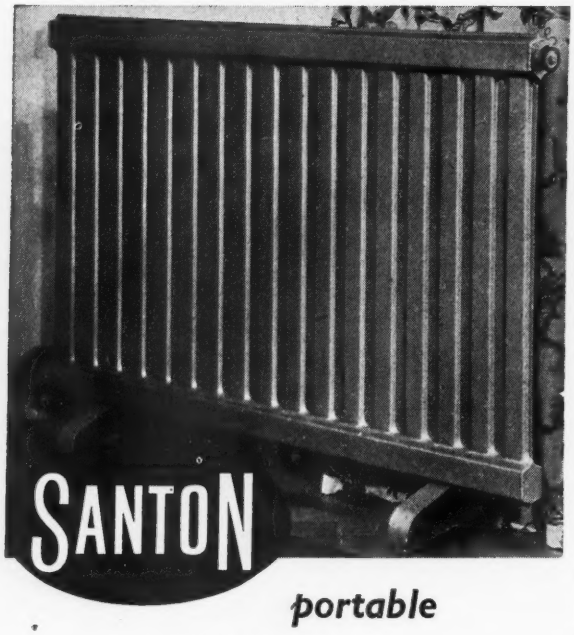

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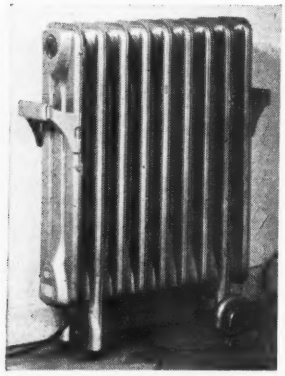

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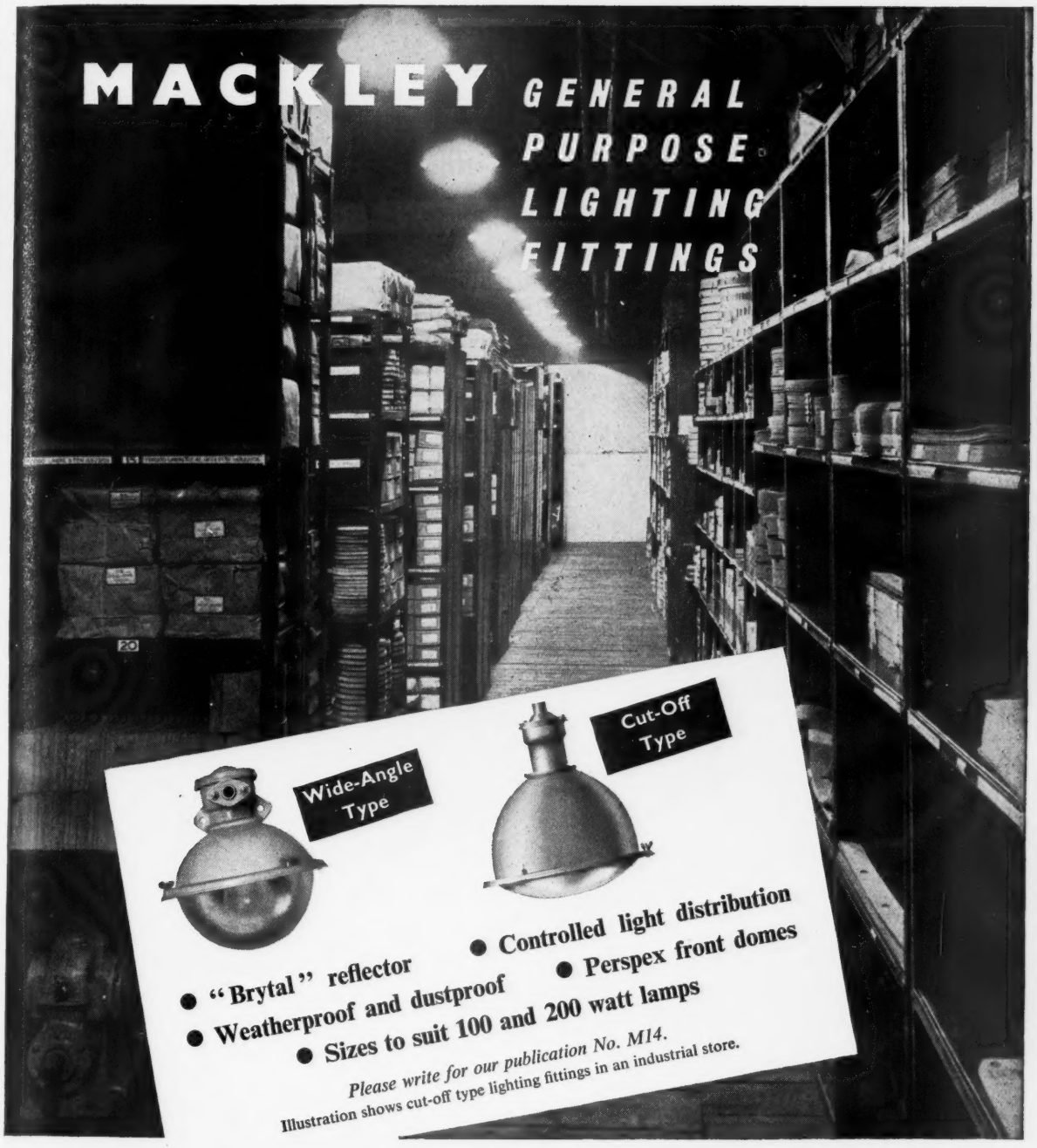
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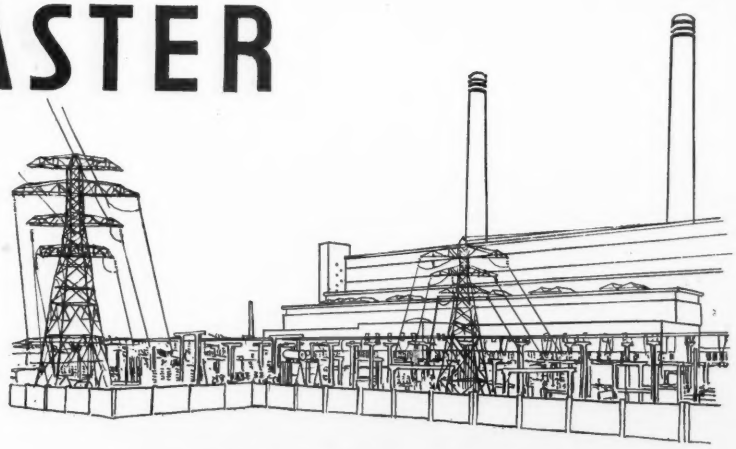
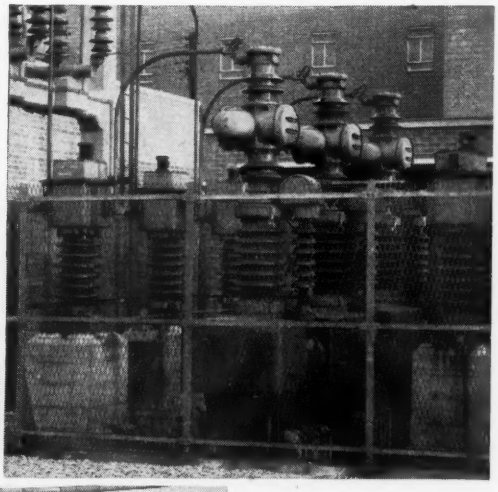
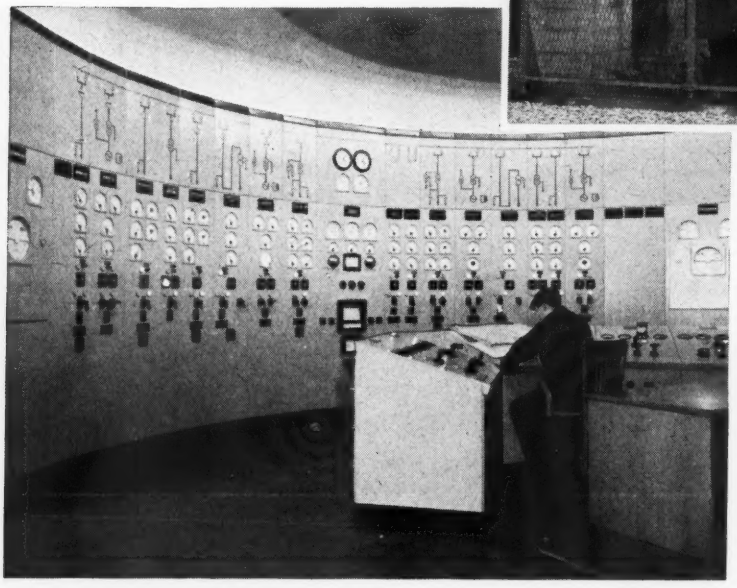
DONCASTER



The 66-kV air-blast and 3·3-kV air-break switchgear and control equipment for DONCASTER 'B' Power-Station were supplied by REYROLLE





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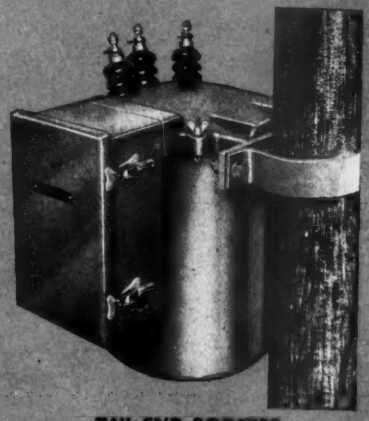

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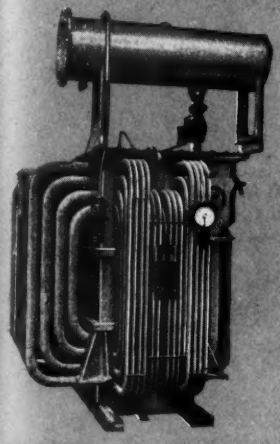
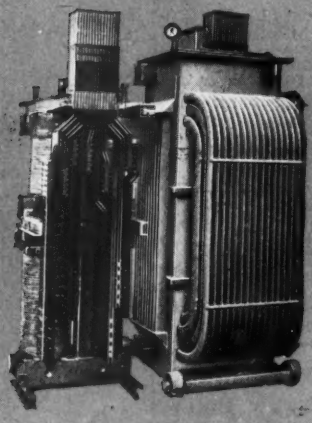


DISTRIBUTION TRANSFORMER
Ground mounting outdoor type. Ratio 6,600/3,300 volts, 3 phase, with an output of 2,500 KVA.



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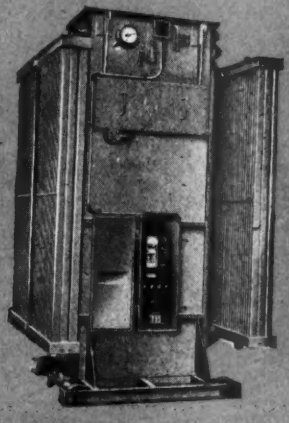

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3270 KVA. Automatic Line Regulator for control of 25,000 volt, 3-phase, 60-cycle system providing voltage range of ± 10%.

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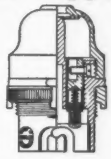
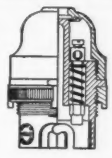
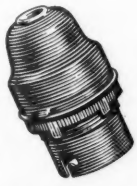
Terminals stationary during lamp insertion or removal.





SOLID PLUNGERS

Terminals move during lamp insertion or removal.



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CORD GRIP "DREADNOUGHT"

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Spring or solid plungers. With screwed bush and grommet, to grip 14/.0076 round twin T.R.S.

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Spring plungers. Easily wired body removes from base rear. 2" fixing centres. Available with "loop-in" third terminal.

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Spring or solid plungers. With shade carrier ring. Without cap. For clamping through a metal or other plate.

"Ashley" Home Office pattern shield

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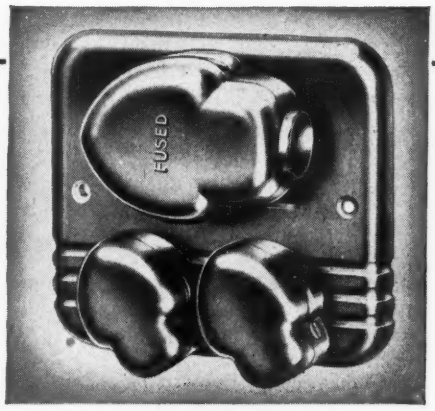

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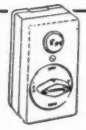
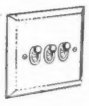
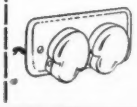

PILOT CONTROL SWITCHES


TUMBLER SWITCHES


TWIN TWO SOCKETS

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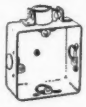
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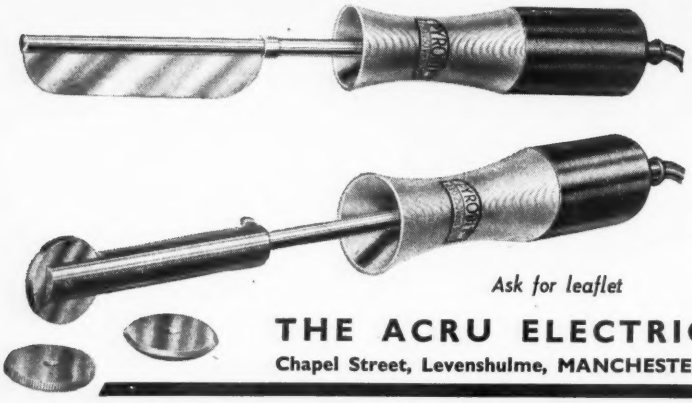

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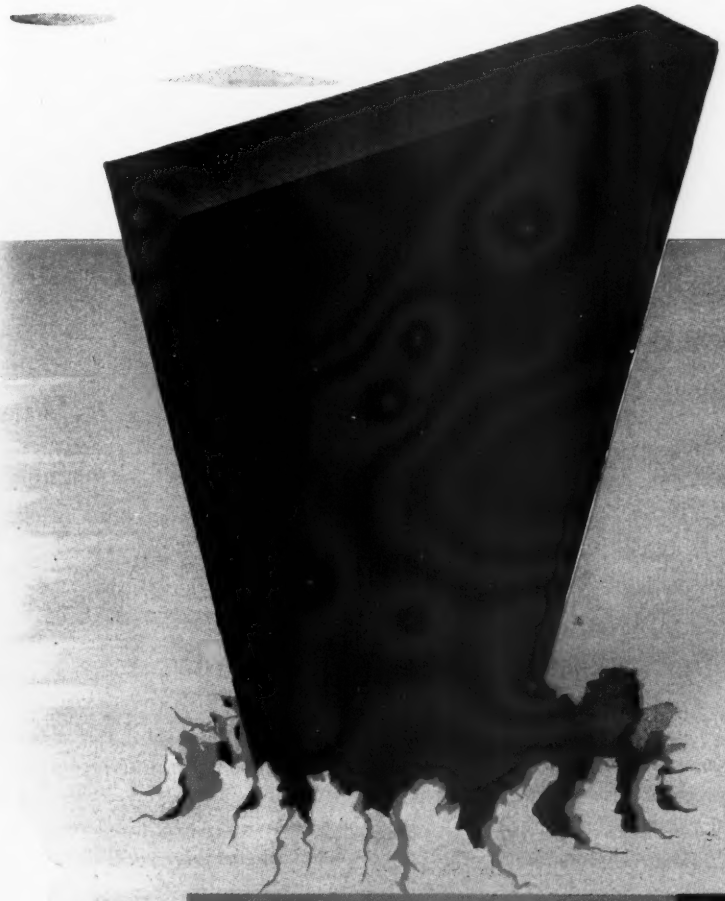

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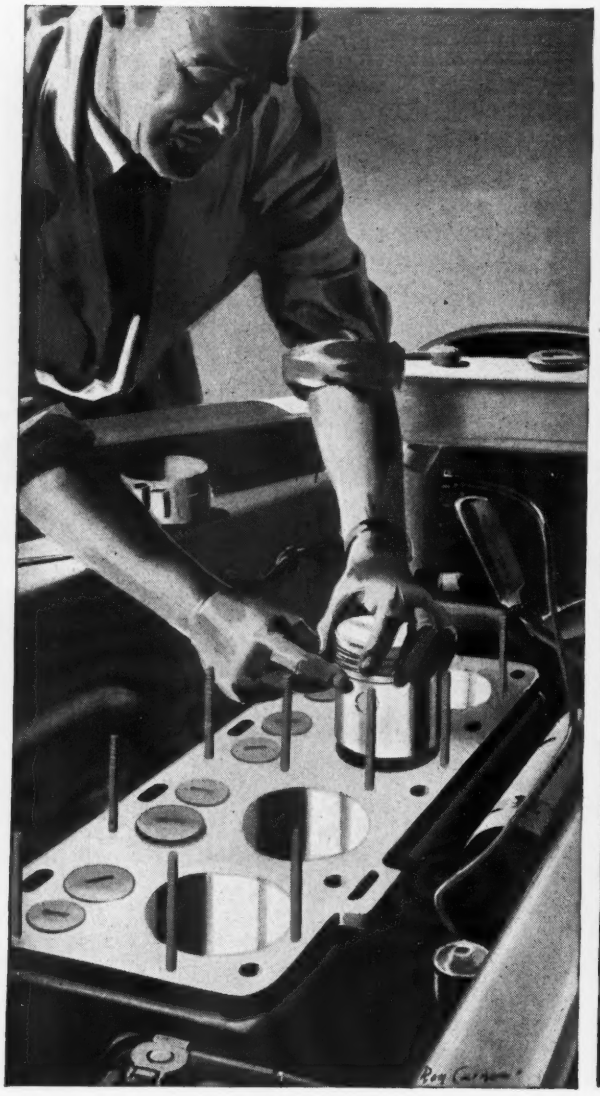

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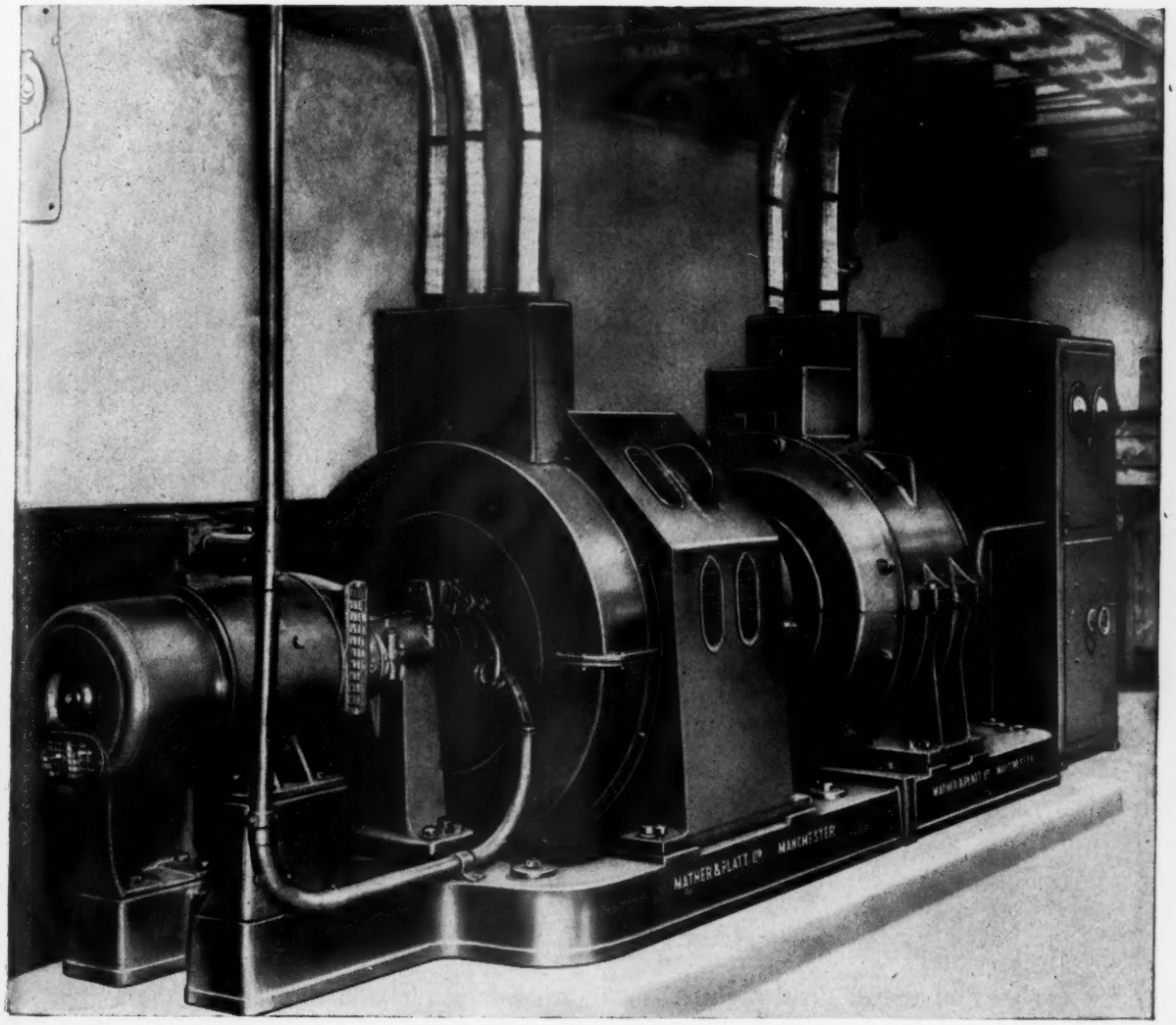

438

POWER *for industry*

The motor generator set illustrated is installed at a South of England paper mill. The motor is a direct-on started 435 h.p. synchronous machine, 400 v., 0·5 leading power factor, 1,000 r.p.m., starting current 2½ times full load current. The D.C. generator supplies 300 kW at 230 v.

MOTOR GENERATOR SETS

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New Houses
and the Balance of Power

WHEREVER YOU LOOK, new houses are going up—houses to make homes for families who know the value of electricity as a maid-of-all-work. They won't do without it.

The newly-housed families use electricity for labour-saving power, for light, heat, cold—in the refrigerator, for the weekly wash, for entertainment and for many other purposes. In all these ways, electricity helps to make the home a better and a happier place. But how about all the other users of electricity—industrial users and farmers, for example? Won't they suffer if the new houses use so much? Not at all: it will help them.

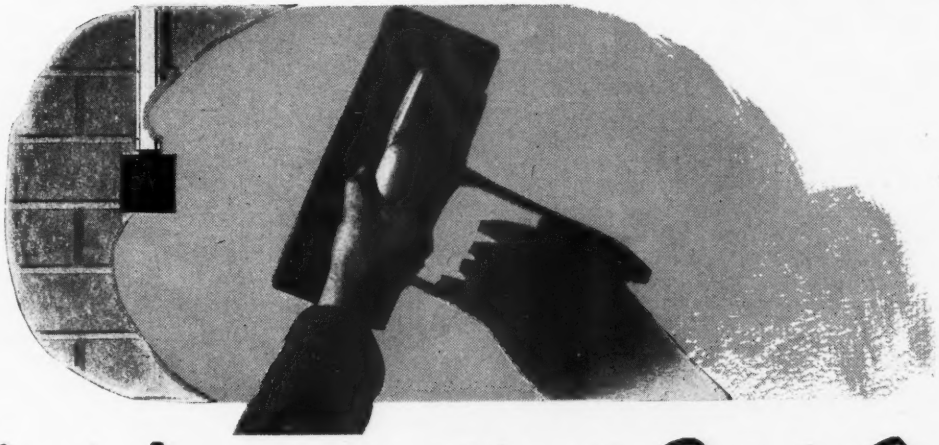
It's a matter of balance. Different jobs need electricity at different times of the day and night. These varied demands help to even out the load on the power stations. When generating plant is continuously operated the price of electricity is kept low. All users benefit, therefore, the more widely electricity is used, for more and more purposes.

SIX YEARS' PROGRESS

40 NEW POWER STATIONS

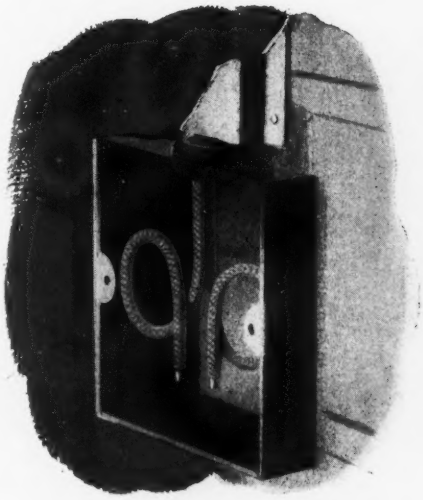
50% MORE POWER

THE "LINCOLN" TYPE AC – A TRUE *PLASTER-DEPTH* SWITCH

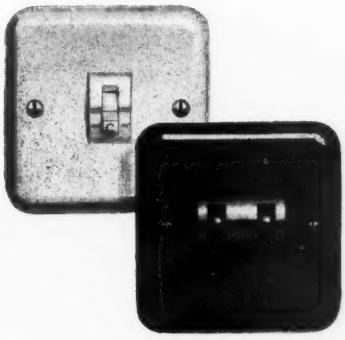


Flush Wiring without Brick Cutting

The "Lincoln" Type AC switch can be mounted in a plaster-depth box and yet leave ample space within the box for cable slack. A flush installation can therefore be provided without the need to cut brickwork. This advantage is so highly valued by the electrical contractor that we have produced a range of plaster-depth boxes which enable the switch to be used with any type of cable or with round or oval conduit. Particulars of these boxes are given in Publication No. R1523, which also lists the attractive prices at which "Lincoln" Type AC switches are offered.



This illustration shows a steel box with one bushed entry, for flexible cable. List No. 9251.



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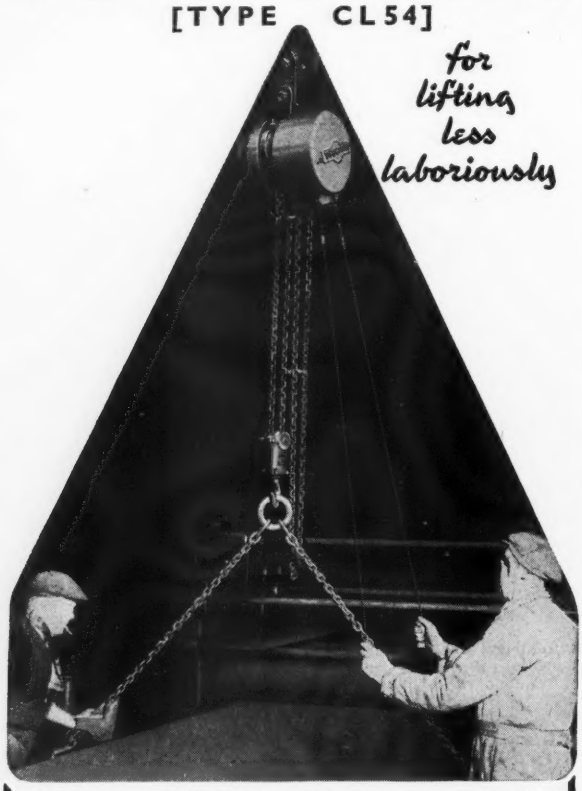
HOIST BLOCKS
[TYPE CL54]

for lifting less laboriously



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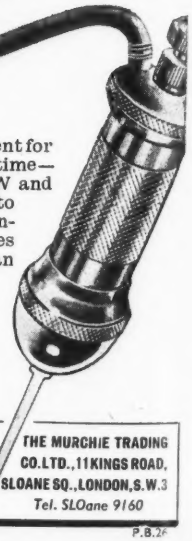
Industrial Stethoscope

THE INFALLIBLE FAULT FINDER



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AIRSONIC has no internal frequency of its own. Acoustically neutral, it responds equally to all frequencies from 20 to 7000 c/s (the entire sound range and beyond). It is self-contained, and independent of outside power.

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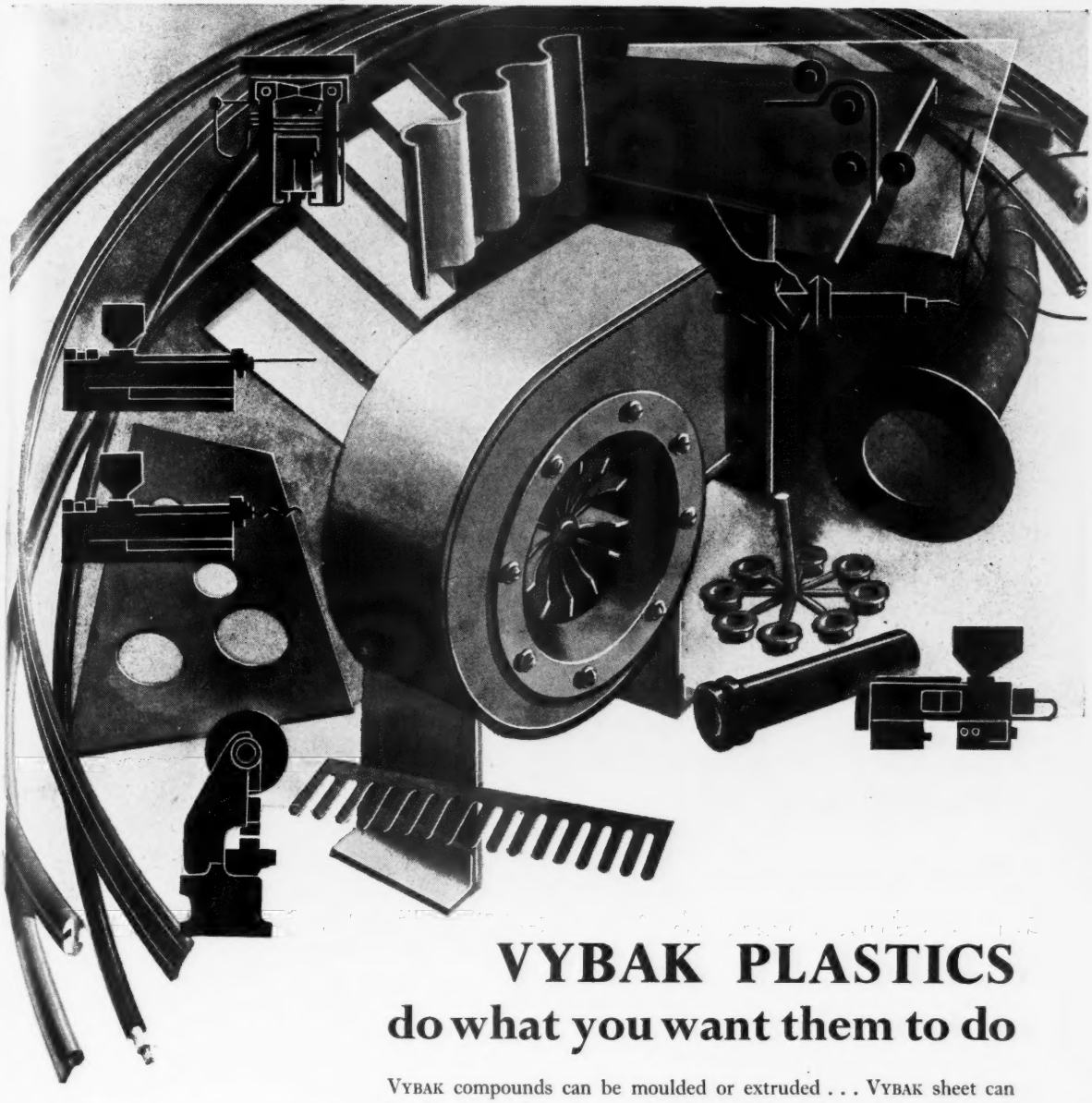

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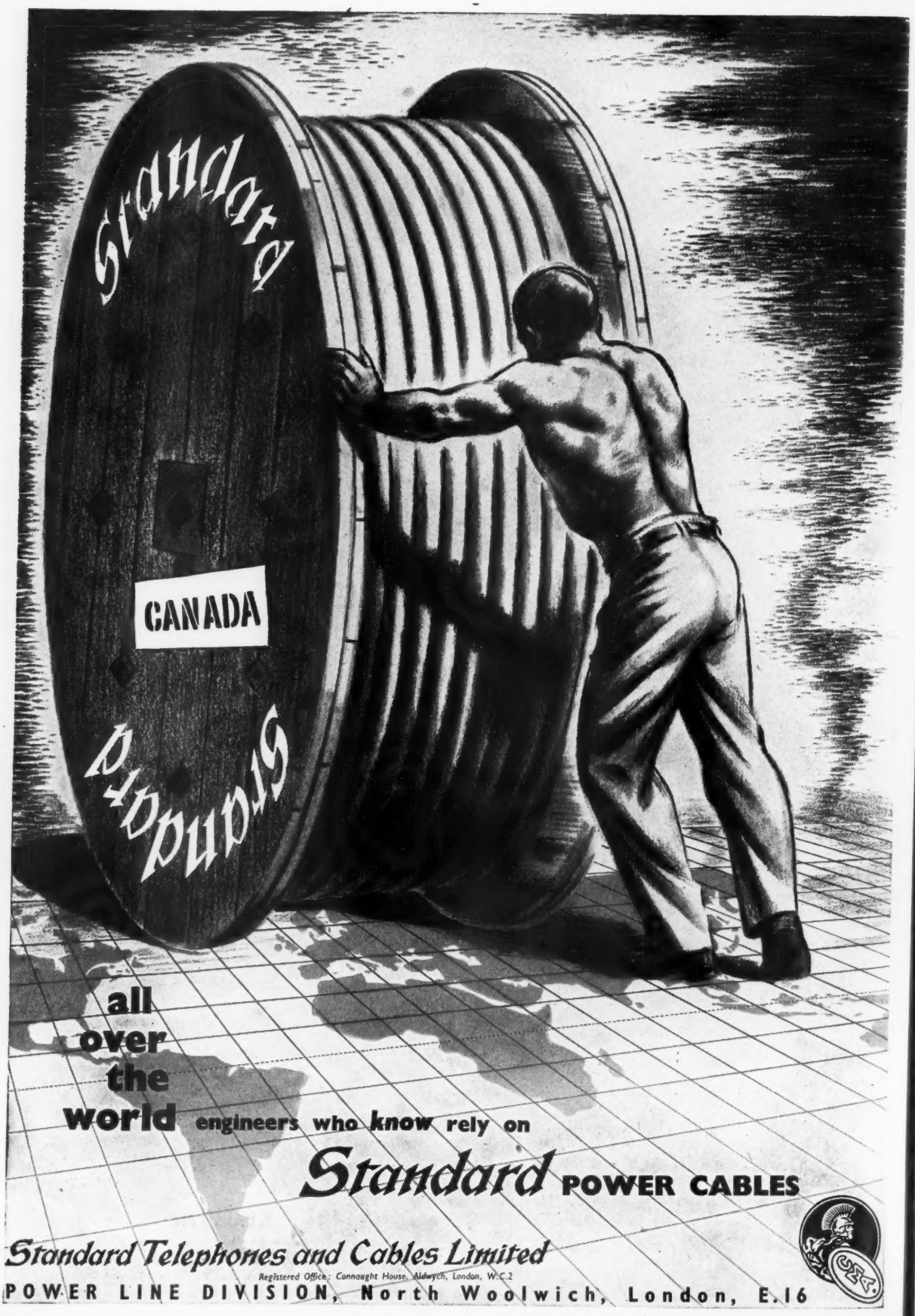

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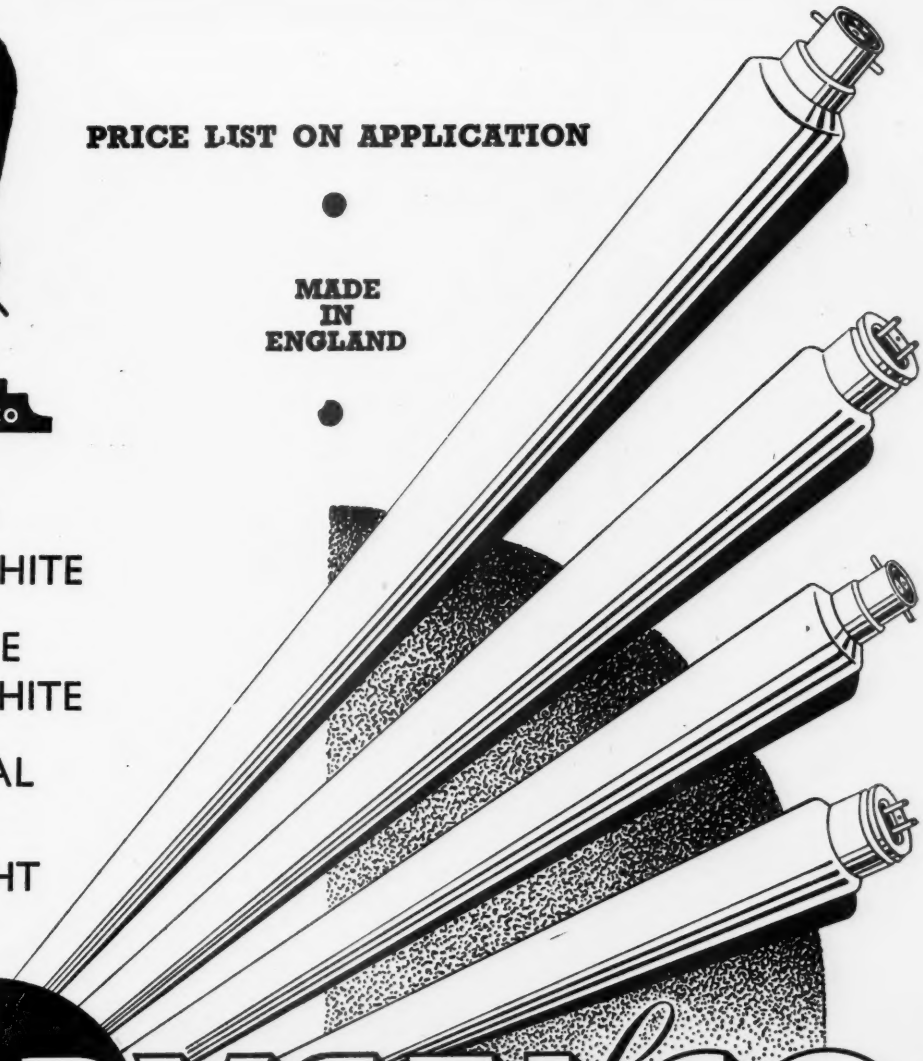

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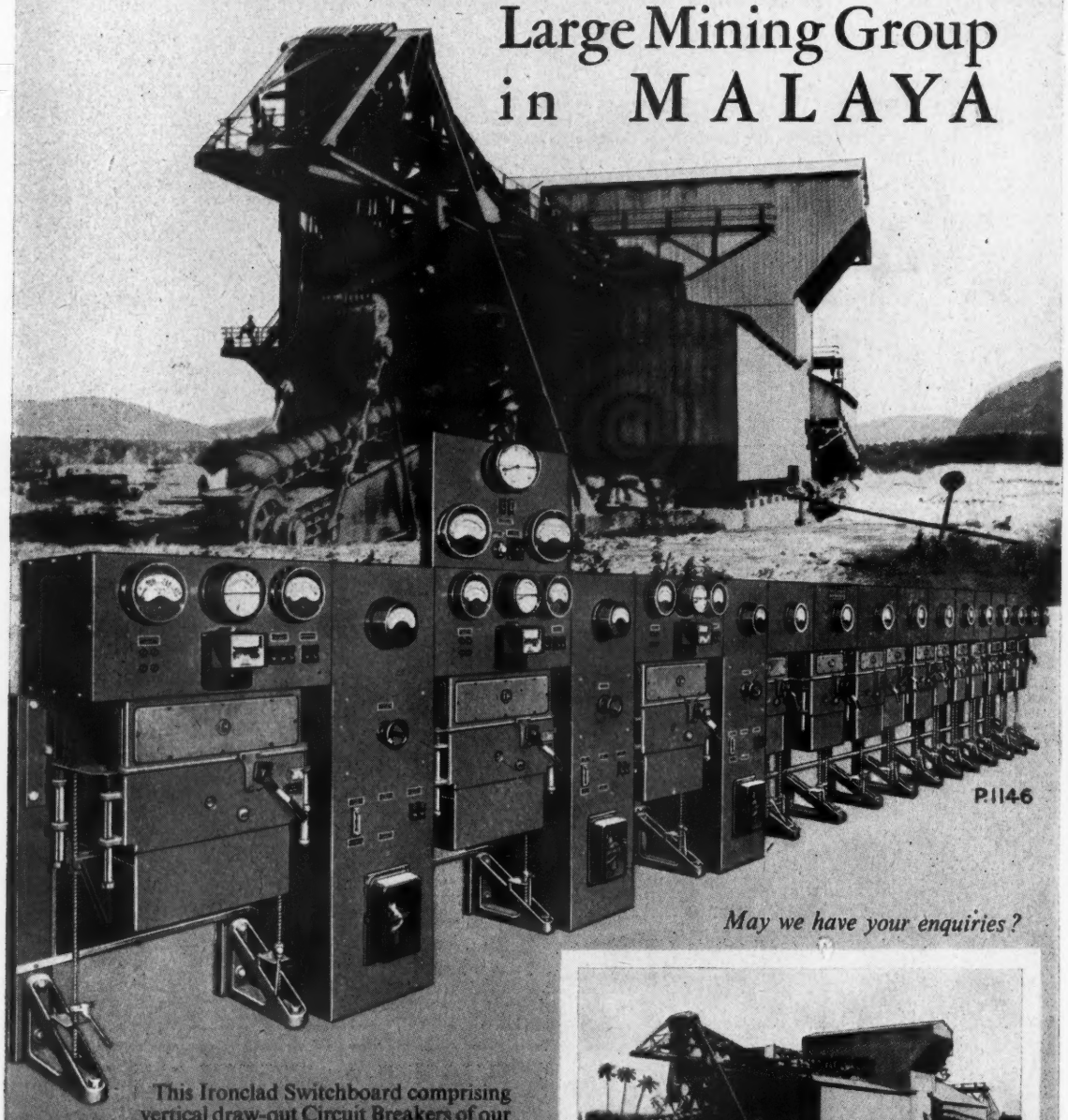

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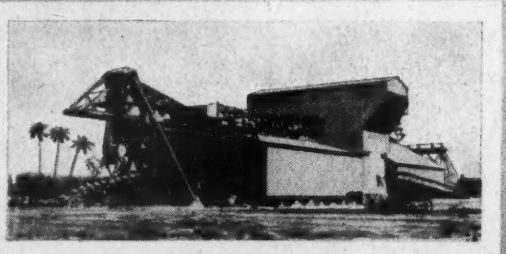

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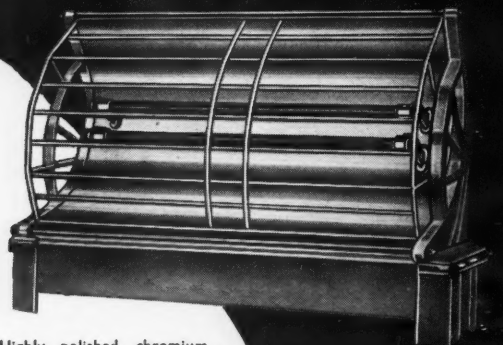

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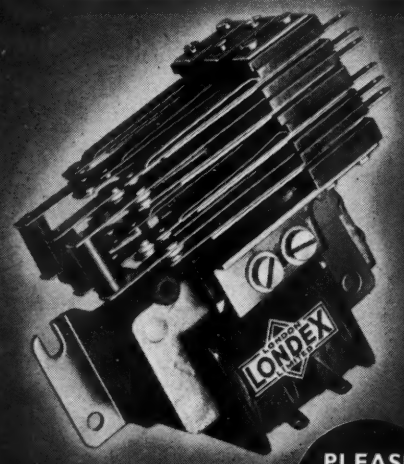

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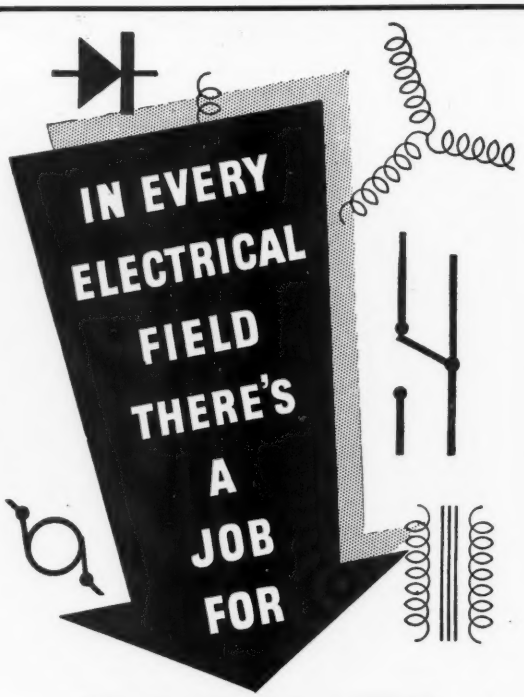

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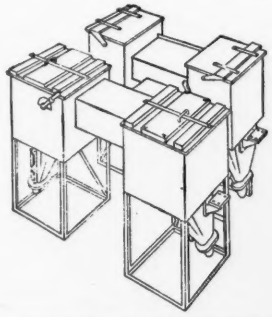
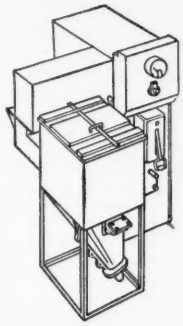
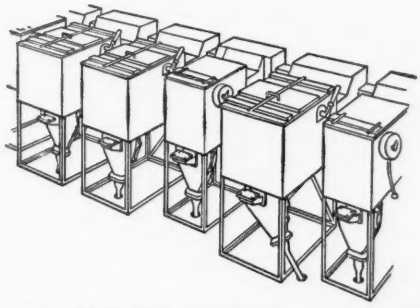


Non-extensible ring main arrangement

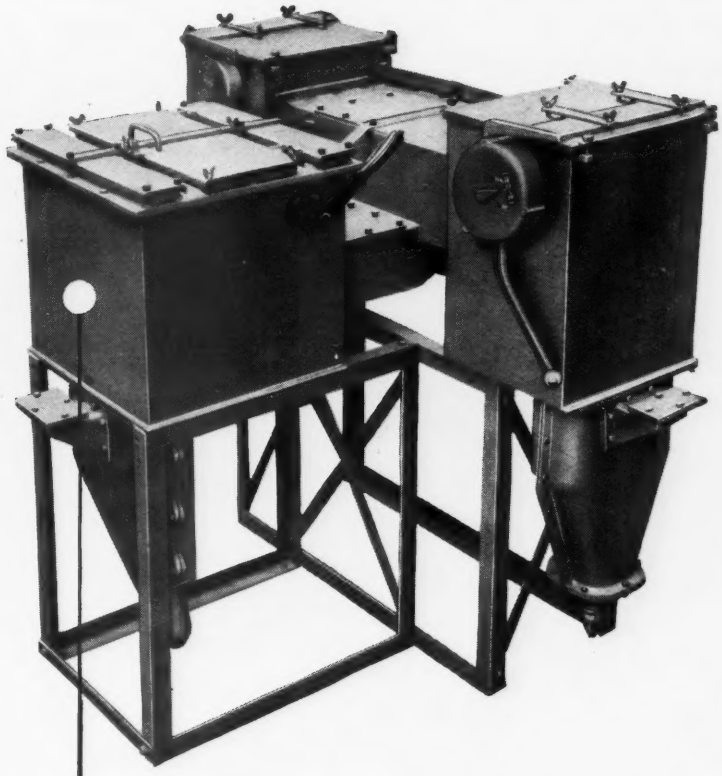


Combined 'OFS' and metalclad circuit-breaker unit



Extensible 'in-line' arrangement

Three of the many combined arrangements of the 'OFS' fuse-switch are shown above.



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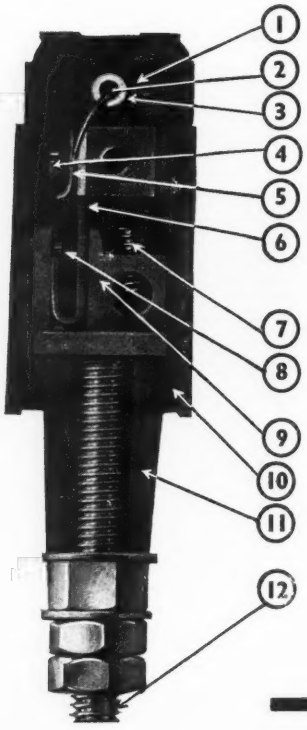

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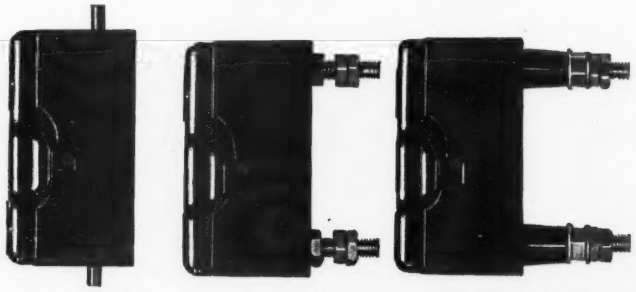

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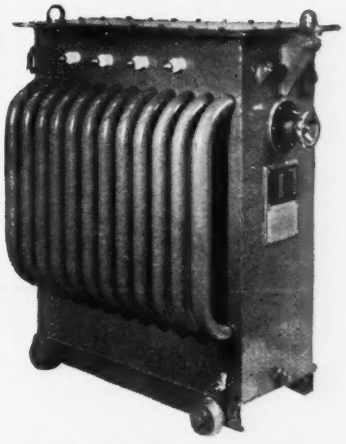

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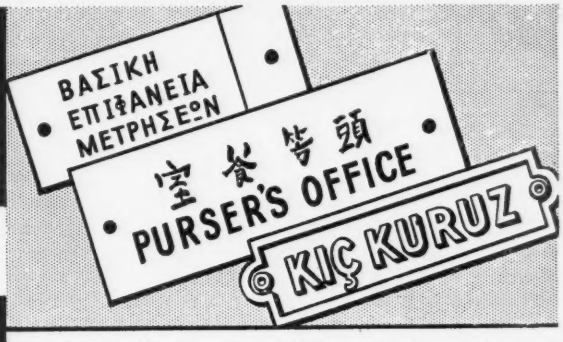

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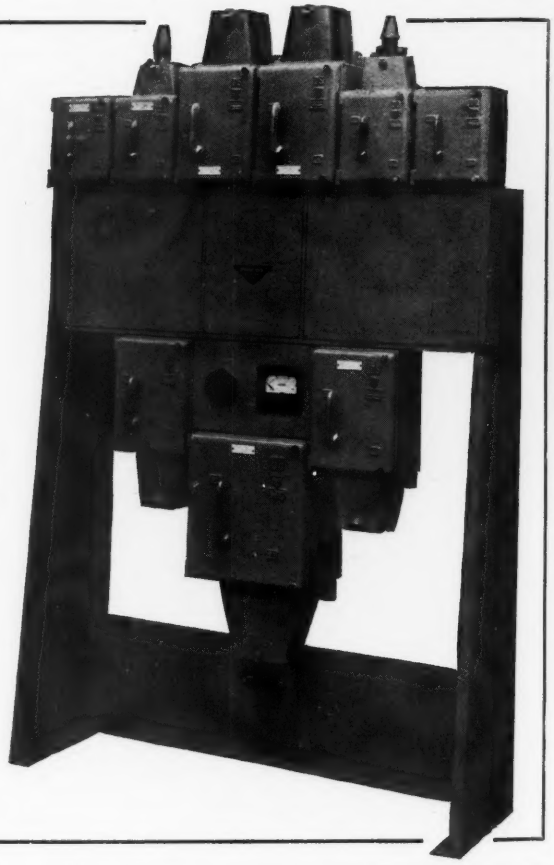

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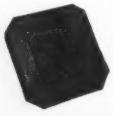

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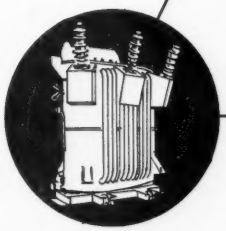

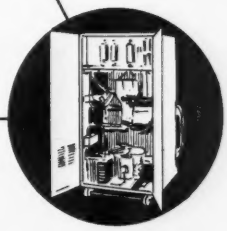

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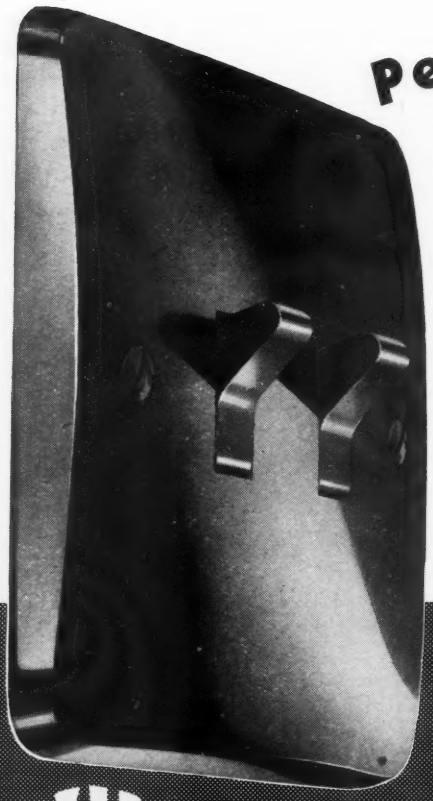

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24 DECEMBER 1954

In This Issue

989 BOILER FIRING
991 CLOSE SPEED CONTROL
995 SUPERCONDUCTIVITY
997 DOMESTIC WIRING
999 HORTICULTURE IN THE NORTH WEST
1000 TESTING ALTERNATOR END-WINDINGS
1001 ERECTION OF PLANT
1002 ENGINEERING IN EUROPE
1003 ELECTRICAL PROGRESS—1954
1004 WASH BOILERS
1007 VIEWS ON THE NEWS
1008 PERSONAL AND SOCIAL
1012 LETTERS TO THE EDITOR
1013 INDUSTRIAL NEWS
1017 JAPANESE ELECTRICAL MACHINERY
1019 EARTHING
1021 NEW ELECTRICAL EQUIPMENT
1022 GENERATION AND DEVELOPMENT
1023 FINANCIAL SECTION
1025 NEW PATENTS
1026 CONTRACT INFORMATION

89 CLASSIFIED ADVERTISEMENTS
102 INDEX TO ADVERTISERS

VOLUME 155 ✧ NUMBER 26

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ELECTRICAL REVIEW

24 December 1954 Vol. 155 No. 26 Established 1872

Boiler Firing

BECAUSE, presumably, in the very early days of pulverized-fuel firing it was considered largely as a means of using up the huge stocks of very low quality coal lying waste throughout the country, the idea lingers that p.f. firing is particularly suited to the consumption of very low-grade coal—perhaps the only method of firing the very lowest grades of the fuel. An outstanding example of p.f. firing with this object was the Tir John power station, then owned by the Swansea Corporation Electricity Department, which had boilers specially designed for the consumption of South Wales anthracite duff. This station was described in the *Electrical Review* of 3rd May and 28th June, 1935.

In his article " Boiler Firing Methods " in the *Electrical Review* of 26th November, 1954, however, Mr. E. J. Payton makes a very good case for p.f. firing on its merits as against both normal chain grate stoker firing and combined chain grate and spreader stoker firing; indeed the case is so good that one is left with the impression that if high thermal efficiency is to be the only goal then the only sound means of reaching it is p.f. firing, using the highest possible grade of coal.

But Mr. Payton visualizes deterioration in the quality of our coal in the future and uncertainty of the supply source, which call for plant dealing with a wide variety of coal grades. Pulverized coal firing certainly lends itself to these conditions; indeed it offers greater flexibility in two respects, in dealing with a variety of fuels and in meeting changing loading conditions. Stoker fired boilers are limited in capacity to about 350,000 lb/hr. The greater changes of loading are not generally experienced by the larger base load stations as they are operated to-day, however, so that the principal advantage of p.f. firing is its adaptability to a wide range of fuel. The author points to the economic necessity of the adoption of large boilers, and he says that p.f. fired boilers will be capable of supplying future 200 MW turbines on the reheat principle.

Mr. Payton offers a number of most interesting suggestions to explain the anomaly that the final gas temperature of p.f. fired boilers is higher than that of stoker fired boilers. We are inclined to think that this peculiarity suggests that we are not yet deriving the maximum benefit from p.f. firing, either in terms of completeness of combustion or by way of flexibility of firing. Be that as it may, the survey of tests and performance given in the article presents a very clear case for p.f. firing against ordinary chain grate stoker firing. We do not feel so sure about its superiority over the travelling grate and spreader method which seems to be an interim development on the way to a combination of both chain-grate and p.f. firing, giving the advantages of each, i.e., more complete combustion and greater utilization of radiant heat. In any case there has been as yet very little experience with the spreader technique.

OIL ENGINE LOAD FACTORS

The comparison of operating costs of heavy-oil engines, compiled by the Diesel Engine Users' Association and referred to elsewhere in this issue, does less than justice to units in electricity generating stations in this country, unless due weight is given to the difference in running load factor between home and overseas plants. Under British conditions this type of prime mover, with its quick starting properties and absence of stand-by fuel charges, is regarded generally as an often useful adjunct for dealing with peak demands or for providing stand-by (requiring, nevertheless, attendance), whereas continuous running is evidently required of units operating abroad. Different methods of allocating costs of labour on repairs and overhaul, no doubt, also affect the figures. The average price of oil delivered at the overseas stations is, somewhat surprisingly, higher than it is here, but is more than offset by a lower consumption in lb/kWh, the higher home figure being presumably due to losses arising from intermittent operation.

ENGINEERING WAGES

An addition of £100 million to the wages bill of the engineering industry, which is the calculated effect of granting the new claim of the engineering trade unions, is one which cannot be contemplated lightly. It is true, as the unions claim, that most branches of the engineering industry have been doing well lately but there are plenty of signs that success in overseas trade, which forms a large part of the business, is becoming even more a matter of price than before. If production per man-hour were to increase with the payment of higher wages the cost would be covered, but there is no way of guaranteeing this improvement. It is reported that the unions are to put forward suggestions for the reconstruction of the wages system. Any alteration which secured a sufficiently greater margin for skilled men would tend to improve the supply of craftsmen and would be welcome.

ARGENTINE TRADE POLICY

British investment in public services in many countries, in earlier days, was followed by regular orders for British equipment and this country thus derived a double return upon the capital spent. In latter years the growth of nationalism (and nationalization) has resulted in the expropriation of these services —not always on terms satisfactory to the owners. Argentina is an outstanding illustration of these altered conditions and a recent address to the British Chamber of Commerce in the Argentine Republic by Mr. Keith Unwin, Commercial Minister to the British Embassy, Buenos Aires, was a masterly exposition of present Argentine trade policy. He showed that Argentina has ambitious plans for the creation of native industries and that its principal import needs are raw materials and capital equipment. Regarding the latter the Ministry of Foreign Trade has stated that Argentina can only afford to finance industrial equipment out of the earnings produced by that equipment and therefore needs deferred terms. The statement (quoted by Mr. Unwin) also included the following:—

> "British capital in an earlier stage of our development financed public services. Foreign investment is no longer possible in this field, but it is to be hoped that new capital and skills will be available to develop industry and mining."

Mr. Unwin said that some British schemes for starting manufacture in Argentina were under consideration and if these were accepted there might be more. But there were many people in England with money locked up in the country who wondered when they would be able to receive its earnings. Mr. Unwin foresaw a "selective and protective" import future for consumer goods with an increasing demand for capital equipment. Competition in prices and terms would be keen.

We extend to our readers our best wishes for Christmas and the New Year and thank all those who have sent us calendars, cards and diaries.

SHORTAGE OF ENGINEERS

In a recent issue of the *Electrical World* Dr. R. H. Trytten, director of the Office of Scientific Personnel of the National Research Council, was reported as saying at a meeting of the American Society of Mechanical Engineers in Milwaukee that America was rapidly falling behind Russia in the race to produce engineers. It seemed probable that the total number of trained engineers in Russia to-day was closely comparable to that in the United States and to accomplish this the Russians had increased the number of engineering graduates from 29,000 in 1948 to more than 50,000 in 1954. In contrast to this, the United States produced only 19,000 graduate engineers in 1954. Perhaps it would be too much to ask where Great Britain stands in relation to all this since the number of technological personnel available in this country in proportion to the population is only about one third of that in the United States.

PUBLIC LIGHTING

For a long time public lighting engineers have been in the main essentially a body of electrical men both by training and their vocational work, and because of the trend towards various kinds of electrical control of public lighting—impulse, radio, etc.—the electrical note is becoming more and emphasized. Until the nationalization of the electricity supply industry these electrical men were mainly members of the electrical industry in that they were to a very large extent employees of the former electricity undertakings which were entrusted in most cases with public lighting. In the absence of the municipal electricity departments, there has been a tendency for the municipalities to establish their own public lighting engineers who, although on the whole they are essentially electrical engineers, are not now so closely tied to the electrical industry. It behoves the industry to see that this important section of electrical men is given full recognition by other branches of the industry.

CLOSE SPEED CONTROL

Metal Rectifier Energized D.C. Motors

By B. FELTBOWER, B.Sc., M.I.E.E.

SPEED control of electric motors within close limits, i.e., a method of control which maintains constant a selected speed, is no new problem, and many schemes have been developed to achieve the required results. The type of control employed will largely depend on the requirements and the characteristics of the drive. In the majority of cases a.c. is available, but standard induction motors are generally not acceptable for this duty because of their speed variation due to changes of load, mains voltage and frequency. The a.c. commutator motors, however, can be fitted with motor driven speed controlling devices (e.g., brush shifting gear or induction regulators) but the response to correcting impulses is comparatively slow, and unless special precautions are taken close speed control with stable running conditions is difficult to achieve due to "over" and "under shooting." This disadvantage is inherent in all schemes which include moving parts.

The most obvious solution where close speed control is required, is the employment of rectifying equipment, thus permitting the use of d.c. shunt- or compound-wound motors, so that speed control by armature voltage or field variation, or a combination of the two methods, becomes possible. Rectification can be carried out by rotating convertors, by thermionic equipment (e.g., gas-filled valves or mercury arc rectifiers) or by metal rectifiers, and the drives to be described here are based on the last system.

The main advantages of the metal rectifier are its instant availability and its ability to supply full load current immediately after switching on, its robustness, long life and relative insensitivity to current surges and overloads of short duration. The space required is generally not very much greater than for valve rectifiers of equal rating, and it scores particularly where it can be connected directly to the a.c. mains without the use of a step-down transformer. Natural air cooling is employed for quite large ratings, obviating the use of cooling fans, but air blast cooling may be resorted to for ratings in excess of about 50 b.h.p. to reduce space requirements.

Total space requirements of air-cooled three-phase 415 V metal rectifiers; this includes space required for proper circulation of cooling air

Motor h.p.	Mean d.c. volts	Space cu ft	Method of cooling	Step-down transformer cu ft
8	220	7·5	Natural	1·75
15	500	12·7	,,	—
25	500	22·5	,,	—
35	500	35	,,	—
120	500	80	Air-blast	—

The efficiency of the rectifier between quarter load and full load is high and the regulation does not exceed about 4 per cent within these limits. The apparent power factor too is high, being near unity over a wide load range. Fig. 1 shows the voltage regulation curve of a three-phase rectifier supplying d.c. to a 15 h.p. motor and Fig. 2 illustrates apparent power factor and efficiency of a three-phase rectifier supplied constant-speed motor-alternator set with 5 kVA rated output at unity power factor (motor rating 8 b.h.p.) In view of the comparatively small size of the set a step-down transformer was included to reduce the d.c. mean voltage to 220.

Full-wave rectification is always employed, mainly on account of its better regulation and the reduced ripple content of the direct current which, with three-phase mains, requires no smoothing choke for the armature circuit. (The ripple component of the d.c. output obtained from a three-phase full-wave bridge rectifier is approximately 4 per cent of the mean d.c. voltage, mainly at a frequency six times that of the supply.)

Methods of Control

The motors for these drives are usually of standard design and where required can be built for an armature supply of 500 V d.c., which is the mean d.c. voltage obtained when rectifying 415 V, three-phase a.c. They are lightly compounded and fitted with inter-poles. Commutation is generally good despite the ripple content of the d.c. supply.

Close speed control is always effected by field variation. If no tapped or variable ratio transformers are included in the a.c. input side to the rectifier, the drive is of an essentially constant speed nature, although generally a

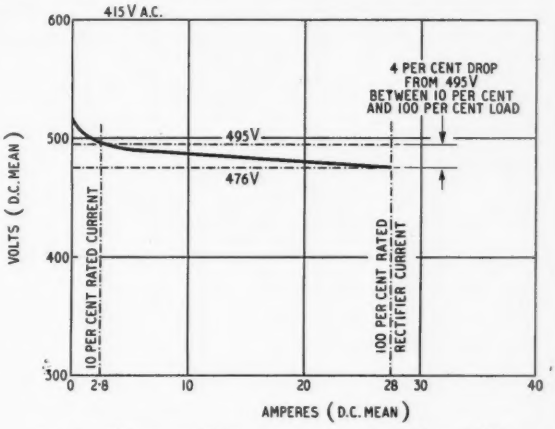


Fig. 1.—Voltage regulation curve of a three-phase bridge connected full-wave metal rectifier. Maximum d.c. rating 28 A 520 V

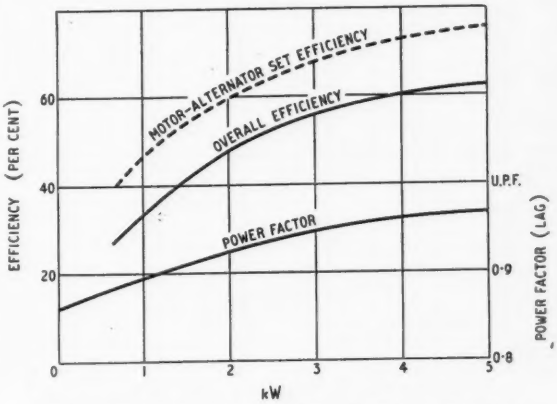


Fig. 2.—Apparent power factor and overall efficiency of rectifier supplied constant-speed motor-alternator set, rated output at unity power factor 5 kVA

speed range of up to ± 10 per cent can be obtained by field adjustment. The inclusion of induction regulators in the a.c. system will permit speed variations within a range up to approximately 3 : 1 by armature voltage control, close control of the set speed still being achieved by superimposed field control. The greater time constant of the field circuit in comparison with that of the armature may be of some disadvantage but by special field construction and by the use of fully laminated iron circuits, it is possible to reduce this time constant considerably. In practice the performance of motors controlled by this method compares well with that obtained by armature voltage control employing, e.g., grid-controlled gas-filled valves.

Several methods have been found useful for supplying the controlling current to the motor field when close speed control with quick response is required, and two particular ones will be described in greater detail. If the motor size is no larger than about 15 to 20 b.h.p. and constant output speed is required, control can be carried out through an auxiliary field, acting in opposition to the motor main field (see Fig. 3). The latter is either excited from the main rectifier or through auxiliary transformer-rectifier units if the 500 V armature supply should be found inconvenient for this purpose. The main field alone will produce a motor speed below that required for the drive.

The auxiliary field, when energized from the speed regulator, will cause weakening of the motor field and thus a rise in speed. A speed range of up to ± 10 per cent is generally obtainable by variation of the auxiliary field with automatic control of any speed in this range within ± 0·2 per cent for load variations from no load to 125 per cent load and mains voltage variations of ± 7 per cent. The drive is insensitive to mains frequency variations.

The output from the regulator is limited to about 100 W and for motors of larger rating a different method of field control is adopted, employing a separately excited negative exciter booster (see Fig. 4). In this case, the motor has one shunt field winding only and this is controlled directly through the booster. The armature of the latter is connected in series with the field winding and, when this auxiliary machine is unexcited, maximum motor field is obtained. Excitation of the booster will cause a voltage to appear across the armature. This voltage will oppose the field supply, thus causing a reduction of the current flowing through the motor field and a rise in speed.

The booster can either be driven by the main motor, or, if this should prove inconvenient, by a separate a.c. induction motor. The accuracy of control and the speed range obtainable are the same as those mentioned above for auxiliary field control. The addition of this rotating auxiliary generator does tend to increase the time constant of the control scheme. It is, however, of little practical importance compared with the time constant of the motor field and the inertia of the driven load.

In both instances the motor is started in the conventional way by rheostatic starters and will accelerate with maximum field, i.e., the auxiliary field or booster field being unexcited. Only after all starting resistance has been cut out is excitation applied by the regulator to permit the motor to accelerate further up to full speed. This acceleration is controlled to avoid rise of armature current beyond a pre-set value. The drive is inherently safe, any fault in the regulating system causing loss of output from the regulator and reduction of the motor speed to that equivalent to maximum field.

Accurate speed regulation is based on closed loop servo-control. The regulator employs hard vacuum valves which require only a short pre-heating period before h.t. can be applied. Generally the time interval between

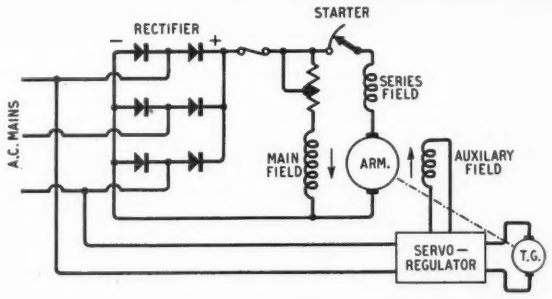


Fig. 3.—Simplified diagram of constant-speed drive with auxiliary field control

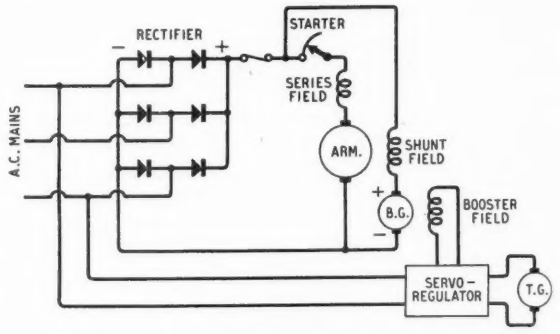


Fig. 4.—Basic diagram of constant-speed drive with negative exciter booster control

switching on and cutting out the last armature resistance step is sufficient for this purpose, provided that this delay is of the order of about 15 sec. The valves employed are all of standard commercial manufacture and are readily obtainable. Magnetic amplifiers could also be used for this purpose but it is more difficult to obtain stable running conditions on account of the larger time constant of these devices, particularly when operating on 50 c/s mains.

A permanent magnet d.c. tachometer generator is coupled to the motor, producing an output voltage proportional to the speed. The design of this reference generator is critical since the accuracy of speed control will depend on its stability and performance. Slot ripple should be reduced as far as possible; the speed-output e.m.f. characteristic should follow as nearly as possible a straight line and, where reversing drives are required, the voltage generated with clockwise rotation should be the same as that produced with anti-clockwise rotation. For long term drift-free operation, the field developed by the permanent magnet should be temperature compensated to ensure constancy over the normal temperature range. Uncompensated machines may show output voltage variations of up to 0·05 per cent/deg C mainly due to flux changes of the permanent magnets (e.g., the temperature variation of the flux of an "Alnico" magnet is 0·03 per cent/deg C).

The external load impedance in the generator armature circuit is kept high to reduce the current flowing and so minimize heating of the armature windings, thus also reducing IR drop variation due to armature resistance changes. Where exceptionally close control of ± 0·1 per cent or better is required, the armature may have to be wound with a resistance material with negligible temperature coefficient. The output of these machines is in the region of 5 to 7 V per 100 r.p.m. Little trouble and interference has been experienced due to variation of brush resistance. Copper-graphite brushes have been found satisfactory for

most purposes. Some manufacturers, however, claim that silver-graphite brushes provide less day-to-day variation of brush drop changes, particularly when used with silver-palladium commutators.

Permanent magnet rotating field a.c. generators have also been used, thus avoiding slip rings and brushes, but the d.c. permanent magnet generators generally give better results. This is probably because no rectification of the output voltage is necessary. Rectifiers in the input circuit of the servo regulator may cause drift due to their temperature sensitivity.

The mounting of the generator also requires careful consideration. Not only should it be rigidly coupled to the motor shaft, it should also be well insulated thermally and magnetically from the latter and the motor main frame, to avoid transmission of heat and stray fluxes. The latter are mainly transmitted through the shaft and are usually of a pulsating nature. They could be produced by the interaction of the armature reaction field with a stator field due to one of the harmonic currents in the rectified field supply. These stray fluxes will generate voltages in the armature of the permanent magnet generator which are superimposed over the fundamental voltage, and when amplified can cause either unstable working or interference with close control.

Reference Voltage

The voltage generated in the permanent magnet machine is compared with a fixed d.c. reference voltage and the difference, which is proportional to the deviation of the speed from the set nominal value and is commonly called "the error," is employed to control the auxiliary field or the booster field in an appropriate manner to maintain constant the tachometer generator voltage and thus the speed.

The fixed reference voltage can be obtained either from a stabilized source of supply connected to the a.c. mains or from a h.t. battery. With the latter, it is possible to obtain over short periods speed control within $\pm$ 0·1 per cent or better between no-load and full-load. The temperature of the battery, which is generally of relatively considerable thermal mass, does not follow so readily variations of the ambient atmosphere as do the comparatively small stabilizing valves. Both are always mounted in a position where heating due to other components in the equipment is restricted as far as possible. No current other than the grid current of a highly sensitive thermionic valve is drawn from this source of reference under working conditions, and no current at all during idle periods. The life of a battery is generally equal to its shelf life and satisfactory service from batteries for periods in excess of one year are not uncommon. The output voltage is highly stable and only affected by gradual changes due to temperature variations and to ageing.

Actual information in regard to the variation of the open circuit voltage of a dry cell is rather limited. Morris and Bishop* give a variation of + 100 mV/deg C for a 120 V dry battery, i.e., $1{\cdot}25 \times 10^{-3}$ V/deg C per cell. Other more up-to-date sources have observed figures in the region of 4×10^{-4} V per cell per 1 deg C (over the temperature range of − 20 deg C to + 25 deg C). The temperature coefficient may also vary due to the constitution and construction of the cells and also on account of the effects of ageing. Measurements of drift caused by temperature variations seem to lend support to these statements.

Better results are obtainable with secondary cells. For some of these (of the lead-acid type) a temperature coefficient of $+ 2 \times 10^{-4}$ V/deg C per cell has been quoted.† Such cells, however, need constant attention, special charging facilities, and have to be left undisturbed for some time before being put to use, to ensure that gassing has completely ceased.

Gas discharge valves have lower temperature coefficients. They therefore provide a more stable source of e.m.f. over long periods. Typical figures for new valves as quoted by the makers are $- 2{\cdot}7 \times 10^{-3}$ V/deg C for type 85A2 (Mullard) with an average burning voltage of 85, and $- 10 \times 10^{-3}$ V/deg C for valve type 150B2 (Mullard) with a burning voltage of 150. A tendency to increase this sensitivity with ageing has been observed, causing increases in, e.g., the 85A2 up to 5×10^{-3} V/deg C in the worst cases. Two valves connected in cascade and supplied from the mains through a transformer and full-wave rectifier have been found useful in reducing to negligible proportions transient output voltage variations due to mains voltage changes. It is advisable to employ high-stability valves such as the 85A2 and 150B2 as shown in Fig. 5. In order to make full use of the stable burning characteristic of these valves, it is essential that they are run at the correct load current values as stated by the makers and also that these currents do not vary greatly. The load is constant and most conveniently arranged in the form of a high ohmic potentiometer to allow ready adjustment of the reference potential to the required value. No current apart from grid current is drawn from this source. A slight and rather erratic long-term drift over several hundred hours can be observed.

It can be calculated (see Appendix) that for the arrangement shown in Fig. 5 a change of mains volts of $\pm$ 10 per cent produces a change in the output potential of 85 V of only $\pm$ 50 mV, i.e., $\pm$ 0·06 per cent, neglecting the regulation of the rectifier and the transformer. Actual test results, however, show a slightly larger variation than the above, presumably due to the effect of the ripple current content of the first stage (about 8 per cent of the mean d.c. voltage) and the regulation of the condenser-rectifier-transformer system.

Servo-Regulator

The servo-regulator is essentially a direct coupled amplifier, amplifying the error input signal and supplying the controlling field. Generally, two stages of voltage amplification are employed with an output stage consisting of one to a maximum of four power triodes or tetrodes in parallel. All valve circuits are conservatively rated to ensure long valve life, and unbalance of load sharing, unavoidable when running unmatched valves in parallel, can therefore be overlooked. When valve replacements become necessary, it is, however, advisable to select only valves from the same manufacturing batch for parallel operation.

Feed-back from the output stage is included. This may take the form of an impulse transformer in the control

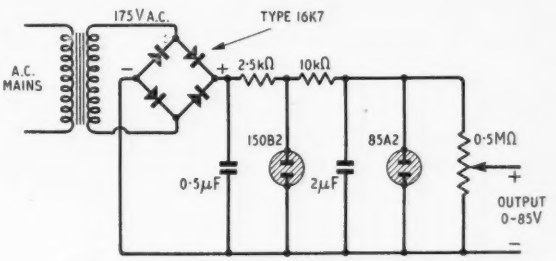


Fig. 5.—Circuit of the stabilized reference voltage source

Electronic Engineering, September, 1949, page 335.

†Yarwood and Croissette, *Electronic Engineering*, February, 1954, page 63.

field circuit, feeding a signal back into the input stage proportional to the rate of change of the field current. This system, however, tends sometimes to slight instability when the regulator is working near its minimum output current (about 0·008 A per output valve), i.e., minimum motor speed at no load. To overcome this, an anticipator network connected to the tacho-generator terminals can be included, consisting of a condenser and resistance, which produces a signal proportional to the rate of change of the error signal.

In addition, load anticipator circuits and current limiting circuits are incorporated. The former may consist of a current transformer in the a.c. circuit and a rectifier, injecting through a differentiating network a signal into the regulator proportional to the rate of change of load current. In some instances direct compounding by a fraction of the load current obtained from the above system has been found beneficial, not only improving the no-load to full-load regulation but also increasing the stability of the drive.

The armature current limiting circuit derives its control either from the same source or from the drop produced by the armature current across a resistance. A circuit found useful for this purpose contains a diode, the h.t. supply of which is biased-off by the above voltage drop so that under normal working conditions no conduction takes place. Conduction will commence only when the voltage drop across the armature resistance exceeds a pre-set value so that a positive signal is applied to the anode. The drop across the load resistance of the diode can then be employed to provide a signal to the regulator, counteracting the impulse from the tacho-generator and thereby reducing the output current so that the motor armature current remains below a pre-set safe value. A sensitive triode with sharply defined cut-off can take the place of the diode, should larger controlling signals be required.

Typical output current range of the regulator for a 15 b.h.p. 1,500 r.p.m. constant speed motor with negative exciter booster control, was 0·008 A to 0·050 A booster field current with a booster field resistance of 3,500 Ω hot. Auxiliary field control of a similar motor, with a speed range of 1,500 r.p.m. ± 10 per cent, required a current range of 0·030 A to 0·250 A with a field resistance of 1,200 Ω hot. In the first case, one KT66 output tetrode was sufficient, while two 12E1 tetrodes in parallel had to be used in the second case. The drive is generally adjusted so that slight under damping exists over most of the working range, two to three oscillations being allowed for transient responses because of sudden load or mains voltage changes.

When the motor is coupled to an alternator for the generation of constant frequency a.c., it is possible to fit the load biasing circuit into the alternator output circuit and a corrective impulse can then be applied to the system before the speed of the set has time to change. Under these conditions frequency control with a minimum of transient variations due to load changes can be obtained.

Acknowledgment is due to the Electro-Dynamic Construction Co., Ltd., for permission to publish this article.

APPENDIX

The relationship between mains input voltage and output voltage of the stabilizer shown in Fig. 5 can be determined as follows. The E/I characteristic of the two glow-discharge valves over the effective working range is for all practical purposes a straight line of the form $E = a + bI$, i.e., the apparent resistance of the valve over this range can be expressed in the form of $R = \frac{a}{I} + b$. This is illustrated in Fig. 6, where b is the incremental resistance

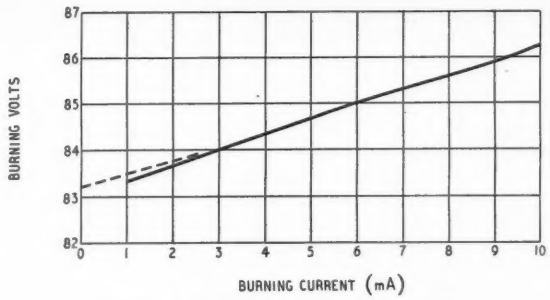


Fig. 6.—Nominal characteristic of valve 85A2

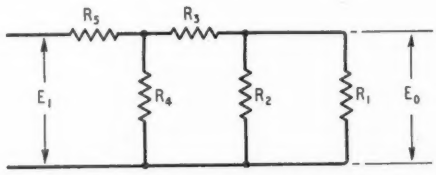


Fig. 7.—Equivalent circuit of the stabilizer shown in Fig. 5

stated by the valve maker and a is the voltage at which the extended E/I line intersects the E axis. Based on the above assumption the equivalent circuit shown in Fig. 7 can be drawn. R_1, R_3 and R_5 are suitably selected high stability resistances, whilst R_2 and R_4 are the apparent valve resistances.

By applying Kirchhoff's laws the following solutions are obtained:

$$I_2 = \frac{E_i}{C} - \frac{B.R_5 + D}{C}; \qquad I_4 = A.I_2 + B;$$

where the coefficients have the following forms:

$$A = \frac{(R_1 + b_2)\,R_3 + R_1\,b_2}{R_1\,b_4};$$

$$B = \frac{a_2\,R_3 + R_1\,(a_2 - a_4)}{R_1\,b_4};$$

$$C = A\,(R_5 + b_4) + \frac{R_5\,(R_1 + b_2)}{R_1};$$

$$D = a_2\,\frac{R_1 + R_3 + R_5}{R_1}$$

From I_2 and I_4 the voltages of the valves can then be found either from the characteristic graphs or more accurately from the equations

$$E_0 = E_2 = a_2 + b_2\,I_2 \text{ and } E_4 = a_4 + b_4\,I_4$$

The equations for the two valves employed based on average valve characteristics are:

$$85A2 : E_2 = 83{\cdot}2 + 310\,I_2$$
$$150B2 : E_4 = 147 + 278\,I_4$$

Hull Telephone Jubilee

MR. DAVID GAMMANS, Assistant Postmaster General, visited Hull on 11th December on the occasion of the fiftieth anniversary of the city's telephone service—the only one in the country that is municipally owned. He said that he was often asked why it was that in Hull an efficient telephone service was provided at a cheaper rate than elsewhere. He explained that while the Corporation was dealing with a compact area the Post Office had to provide services for remote parts of the country. By and large they lost money on every rural subscriber. For example, they had installed about 20,000 rural kiosks, on each of which they lost on an average £40 a year.

SUPERCONDUCTIVITY

An Explanation of the Basic Theory

By K. J. A. BROOKS, B.Sc.(Met.) and R. H. WARRING

ONE of the most spectacular phenomena associated with extreme low temperature physics, and probably the one which shows the most promise of commercial, as well as purely laboratory application, is superconductivity. Briefly this is the property possessed by certain metals and compounds to become perfect electrical conductors at extremely low temperatures.

That this should occur is predictable by theory, the principle involved being that the electrical resistance of pure metallic conductors should gradually decrease to zero at absolute zero temperature (−460 deg F). In practice this theory only holds true for a limited number of conductors—almost exclusively those with the best room temperature conductivities, such as silver (electrical conductivity per cent I.C.A.S.−106), copper (I.C.A.S. −100) and gold (I.C.A.S.−72), when these metals are in their pure state.

Quite a number of other metals, however, possess the property of reaching zero resistance before absolute zero. At such a critical temperature, therefore, they become super-conductors, offering no resistance to the passage of electricity so that a current started in a closed circuit of the material would continue to flow indefinitely with no external source of energy. A practical demonstration of this form of low temperature phenomenon was, in fact, first given some twenty years ago, with a lead ring rendered superconductive by reducing the ambient temperature to within a degree or so of absolute zero. At room temperature lead has a resistance some ten times greater than that of copper.

One of the most interesting features associated with superconductivity is that many of the best superconductive metals are poor conductors of electricity at normal temperatures. Also the phenomenon is not confined to pure metals, or even to metallic substances.

Extensive research work by numerous independent authorities during the past decade has led to a current listing of some twenty metals as superconductive, also a number of alloys and metallic salts. In the case of typical alloys, such as bismuth-gold and bismuth-nickel, neither of the constituent elements themselves is superconductive. The same is true of the metallic compounds which have been found to be superconductive and the best superconductor so far discovered comes from this latter group. The word " best " is here used in the sense that the higher the temperature at which superconductivity occurs the better or easier it is, or should be, to reduce the material concerned to its superconductive state. There are no comparisons of " superconductive performances," as such since each represents the same, exact property, i.e. zero electrical resistance. At the time of writing the metallic compound columbium nitride heads the list with a transition or critical temperature of 15 deg absolute (−433 deg F).

The decrease in electrical resistance with decreasing temperature is not substantially asymptotic to zero with superconductors. The decrease in resistance is quite sudden at the transition temperature within a very narrow zone. A typical resistance-temperature curve would take the form of Fig. 1 where, in the transition zone, a decrease in temperature of the order of 0·8001 deg absolute may halve the resistance value. This characteristic is put to

Table 1.—Low temperature data for various materials

Gas	Boiling point at one atmosphere Deg K	Deg F	Deg C
Helium[3]	3·2	− 453·8	− 269·9
Helium[4]	4·2	− 452·0	− 268·9
Hydrogen	20·4	− 422·9	− 252·8
Deuterium	23·6	− 417·1	− 249·5
Tritium	25·1	− 414·4	− 248·0
Neon	27·2	− 410·6	− 245·9
Nitrogen	27·3	− 320·4	− 195·8
Carbon Monoxide	81·1	− 313·6	− 192·0
Fluorine	86·0	− 309·6	− 157·0
Argon	87·4	− 302·3	− 185·7
Oxygen	90·1	− 297·4	− 183·0

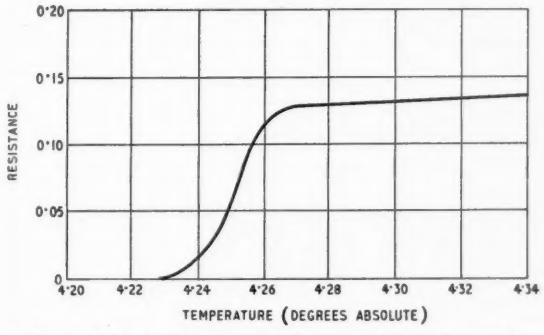


Fig. 1.—Typical resistance curve of a superconductor (mercury). Based on early data (Kammerlingh-Onnes). Modern figures for critical temperature of mercury are lower, e.g., Table 2

Table 2.—Superconducting elements, alloys and compounds (above 1 deg absolute)

Superconductor	Critical temperature or approx. transition temperature (deg K)
Columbium nitride	15·0
Cobalt carbide	10·1
Columbium	9·22
Tantalum carbide	9·2
Molybdenum carbide (MoC)	7·7
Lead—Bismuth	7·3—8·8
Lead	7·26
Lead—Silver	5·8—7·3
Lead—Copper	5·7—8·0
Lanthanum	4·71
Tantalum	4·4
Vanadium	4·3
Mercury	4·12
Lead—Mercury	4·1—7·3
Tin	3·7
Indium	3·4
Lead—Indium	3·4—7·3
Tin—Copper	3·2—3·7
Zirconium nitride	3·2
Tungsten carbide	2·8
Tin—Gold	2·5—3·7
Tin—Thallium	2·4—4·2
Indium—Thallium	2·4—3·7
Molybdenum carbide (Mo_2C)	2·4
Thallium	2·4
Lead—Thallium	2·2—7·3
Tungsten carbide (W_2C)	2·05
Silver—Bismuth	1·95
Titanium	1·8
Copper sulphide	1·5
Thorium	1·4
Vanadium nitride	1·3
Tin—Silver	1·5—3·7
Aluminium	1·14
Titanium carbide	1·1
Titanium nitride	1·1
Gallium	1·07

practical application in bolometers. As yet there is no complete agreement on the basic theory of superconductivity. This has not, however, retarded practical application of the phenomenon and of the behaviour of metals in general at extremely low temperatures.

Considering the bulk of a pure metal (conductor) as composed of a regular lattice, the lattice itself is subjected to thermal vibrations of the individual atoms. The resistance to the passage of an electric current is then directly dependent on the strength of the thermal vibrations. Since these in turn are dependent on temperature, at absolute zero temperature there should be no thermal vibrations and hence no resistance to the " free " electrons carrying the current.

Impurity Detection

The presence of even minute proportions of impurities, however, modifies the regular lattice with the result that with the non-superconductive metals electrical resistance never quite reaches zero, even at absolute zero temperature. The small value of resistance remaining, determined by extrapolation, is termed the residual resistance. Faults within the lattice of a pure metal, such as crystal faults, etc., are also responsible for the element concerned exhibiting a residual resistance.

It has been found practical to adopt determination of residual resistance as a measure of the type, form and amount of any impurities in certain metals, even to the extent of detecting the presence of impurities impossible to trace by other means, or at normal temperatures.

The phenomenon of superconductivity was discovered by Kammerlingh-Onnes in 1911 when investigating the electrical resistance-temperature relationship at extremely low temperatures. The theory was held at the time that the resistance of all pure metals reached zero at absolute zero of temperature. Kammerlingh-Onnes chose mercury as a metal which was one of the easiest to reduce to a very pure state, one of the now known superconducting elements, and discovered the superconductive transition at circa 4·2 deg K. A similar discontinuous curve was not obtained with gold and consequently the two different behaviours of conductors at extremes of low temperature were established.

Concerning the transition period or transition interval in more detail, subsequent experiments have shown that the steepness of the curve is very much dependent on the purity of the superconductor. The higher the purity the narrower the transition interval. The transition temperature, as such, is usually taken as the temperature at which the resistance has dropped to one half of the value of that of the normal metal immediately above the transition range (see Fig. 2). The term critical temperature, when used, is generally taken to refer to the temperature at which the electrical resistance has dropped to zero.

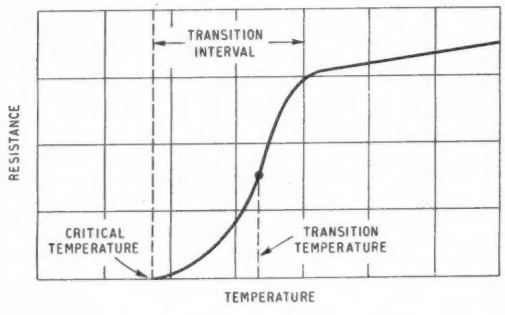


Fig. 2.—Basic definition of transition terms

Since, in most cases, the transition interval itself is extremely narrow, differences between the transition temperature and critical temperature are extremely minute, calling for exact definition and translation of data when applied to practical measurement, particularly as critical temperature is often used generally to describe the transition interval or transition temperature.

Both the critical temperature and the transition curve may be considerably modified by external factors, such as the value of the current used to measure the resistance, the influence of external magnetic fields, mechanical loading, and so on. In general, the larger the measuring current the wider the transition interval and the lower the critical temperature. The presence of an external magnetic field also tends to delay the superconductive state, but the relationship is somewhat complex. If the conductor is put in tension, the critical temperature is raised, and conversely if the conductor is subjected to compression, both relationships having a strictly linear relationship within the elastic limit of the conductor, or to high proof stress values with non-ferrous conductors. One difficulty associated with such experimental work is that the order of magnitude of some of the possible changes in structure of the superconductor at the transition interval may be on or beyond the borderline of practical measurement. The general conclusion is that any changes within the conductor relate only to the conduction electrons.

Results of Investigations

From these and other studies of a similar nature within a range of temperatures close to absolute zero, much useful data are now forthcoming on electron spin and criteria of related interest, of particular application in the field of electronics and electro-magnetism; crystal structure and crystal behaviour, of value in the study of heat treatment, the composition of alloys, etc.; in reaction control in chemical engineering, and so on. It is significant, too, that the discrepancies associated with many earlier researches at extremely low temperatures have been cleared up, or explained, in the light of the most modern data. It has also been proved that a study of the behaviour of metals at extremely low temperatures often provides outstanding facts on which their behaviour at extremely high temperatures can be predicted with considerable accuracy; and even that certain processes which are normally carried out at elevated temperatures, such as the heat treatment of steels for hardening purposes, can be duplicated at low temperatures.

I.E.E. Dinners

THE annual dinner of the South Midland Centre of the Institution of Electrical Engineers will be held on 4th February at the Grand Hotel, Birmingham. Tickets (£1 5s for members and 17s 6d for graduates and students) can be obtained from Mr. E. H. Cox, Midlands Electricity Board, Mucklow Hill, Halesowen, nr. Birmingham.

The North-Western Centre is holding its annual dinner on 8th March at the Midland Hotel, Manchester. Applications for tickets (£1 5s each) should be made by 1st February to Mr. A. L. Green, 244, Brantingham Road, Chorlton-cum-Hardy, Manchester, 21, or to members of the Committee. The annual dinner dance of the Centre Utilization Group will be held on 4th February at the Lesser Free Trade Hall, Peter Street, Manchester. Tickets (26s each) can be obtained from Mr. J. C. Jones, group hon. secretary, the Churchill Machine Tool Co., Ltd., Broadheath, near Manchester, or from members of the Utilization Group Committee.

Domestic Wiring

Installations Designed to Improve the Standard of Lighting

By ARTHUR CUNNINGTON, B.Sc., M.I.E.E.

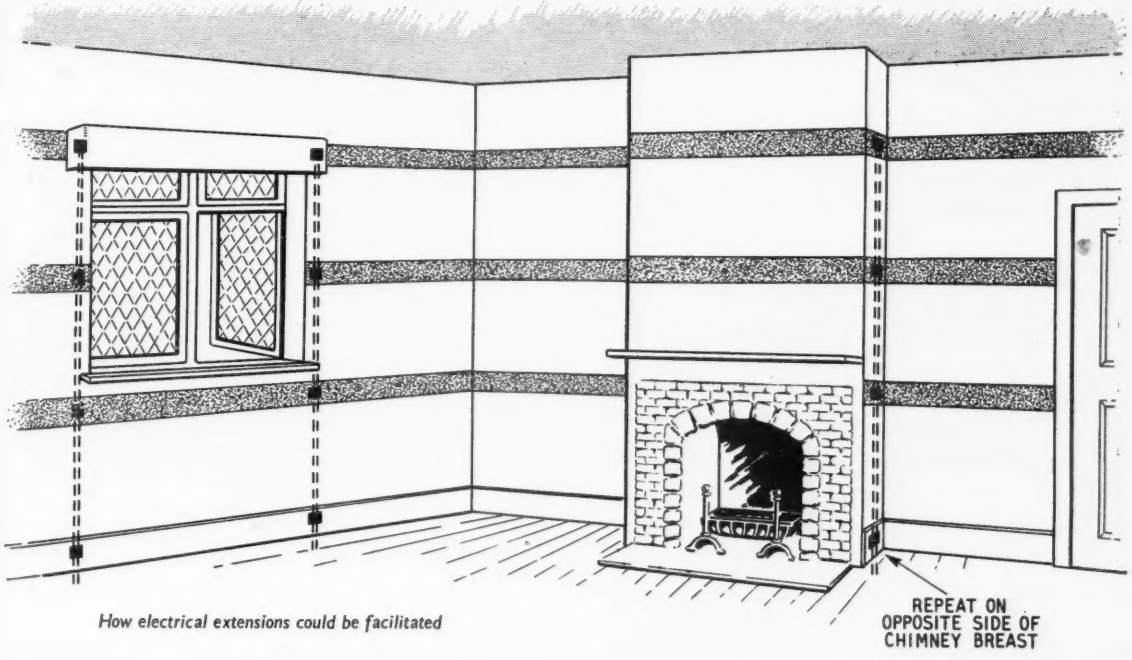
FROM time to time efforts are made to interest the public in modern lighting fittings for the home and not long ago one of the London West End stores had an attractively planned display of domestic lighting. While the designs at this exhibition showed a certain amount of novelty one could not help feeling that there was much more scope for improvement in ordinary house lighting than is visualized at present. The same idea was put forward at the close of an article on "Electric Home Service" by Dame Caroline Haslett (*Electrical Review*, 16th October, 1953, p. 830), who said that "although lighting is the one application of electricity which is universally acclaimed, there is great scope in the domestic lighting field for educating the public into the uses of light for beauty, utility and safety."

What, then, is holding back development in this direction? There are doubtless many reasons for the lack of enterprise in home lighting. There is, for example, a tendency to retain lamp shades that may be old-fashioned but are pleasing in appearance and may have become associated with a particular room as part of the furniture or perhaps as an integral part of the scheme of decoration. The housewife may not take kindly to scrapping such fittings. Then again many new lighting fittings are expensive when related to the comparatively simple shades of the past, and there may be some hesitancy in launching out when changes in fashion are rapid. It is true that attractive fittings have been designed recently in such materials as plastic and plated metal tube and these have not been disproportionately expensive, but if an old-fashioned room has to be transformed to conform with ultra-modern fittings, a good deal of further expense is involved.

It is possible, however, that an even more serious obstacle to the further use of modern lighting apparatus is the absence in most houses of any convenient way of connecting up the many ingenious lighting devices now available. In the demonstration of modern home lighting referred to above connection was facilitated because the walls of the rooms, being temporary, were of plywood on a light framework and it was a simple matter to trail flexible cords through holes in the partitions to reach switches, brackets and pendants wherever they happened to be fixed.

It is, of course, quite otherwise in an ordinary house, and when the owner has bought some fittings such as flat strip-lights for the sides of a shaving mirror, attractive dressing-table lights, or neat little wall brackets for use by the fireside, he will immediately be faced with the problem of fixing them and connecting the supply. He will probably see (if it is an average house) a single lighting socket on one side of the fireplace in most of the rooms and possibly one or two extra sockets at skirting level in the lounge, from which he will have to take a network of trailing flexes, which he may or may not be able to conceal. He will also be faced with the difficulty of fixing fittings on a plaster-covered solid brick wall.

Surely this points to a radical alteration in the wiring of rooms and possibly some change in building construction to enable a room to be equipped after occupation with modern lighting fittings in accord with the individual taste of the owner, and without a complete upheaval of



How electrical extensions could be facilitated

the walls and decoration in the house. The fixing of a reasonable number of socket outlets has already been put forward as a solution of the problem and is certainly useful as far as it goes, but it still leaves us with connections suitable only for such things as radio, a floor standard or a table lamp. Directly we wish to fix lighting fittings high up on the walls for pelmet lights or other concealed lighting, or even for a simple fireside bracket, we are up against the difficulty of making the electrical connection unless we unashamedly run flexible cords in all directions and expose them on the walls, fixed perhaps with insulated staples.

A slight modification in building construction and an intelligent anticipation of likely points for additional wiring outlets would make all the difference and might encourage the use of modern lighting in the home. In the accompanying diagram, which shows two typical walls of a living room, an indication has been given by shading of three horizontal bands in which " Muribloc " or similar material could be built into the walls so as to allow easy fixing of fittings.

To simplify and shorten electrical connections, small connector boxes could be let into the wall at certain " strategic " points, served by vertical rising mains from the usual circuit for socket outlets run at skirting level. Such connecting points would be installed during the construction of the building but they would not be fitted with socket and plug outlets until the lighting requirements of the owner had been decided upon. In other words they would be optional points.

The arrangement shown is, of course, capable of variation according to the taste of the designer. For example, it may be that a channelled picture rail would be run along the top band, or a dado rail might take the place of the bottom band, being hollow to form a duct for wiring. Four vertical risers are indicated in the diagram, but the number would depend on the arrangement of the room, and a similar scheme (with suitable modification) could be applied to a bedroom, kitchen, etc., if the cost were justifiable.

It is obvious that a scheme of this kind would add an appreciable amount to the cost of construction and wiring in a house, but appreciation of the advantage of being able to plan or alter one's lighting scheme *after* occupation and without the expensive redecoration which inevitably follows any major wiring alteration under existing conditions, should overcome objections to the initial expenditure involved.

No doubt there are many other ways in which electrical connections to fittings might be improved, but this is put forward as one solution of a problem worthy of the attention of architects, builders and electrical contractors, in order to encourage the use of modern lighting fittings in the home.

Modern Arc Furnace Design

ONE of the most modern types of arc furnace for steel melting has recently been supplied to the Clyde Alloy Steel Co., Ltd., by G.W.B. Furnaces, Ltd., to the design of L. Tagliaferri of Milan. The installation incorporates a hydraulically operated system of electrode regulation which has been largely responsible for the high efficiency obtained with this particular furnace.

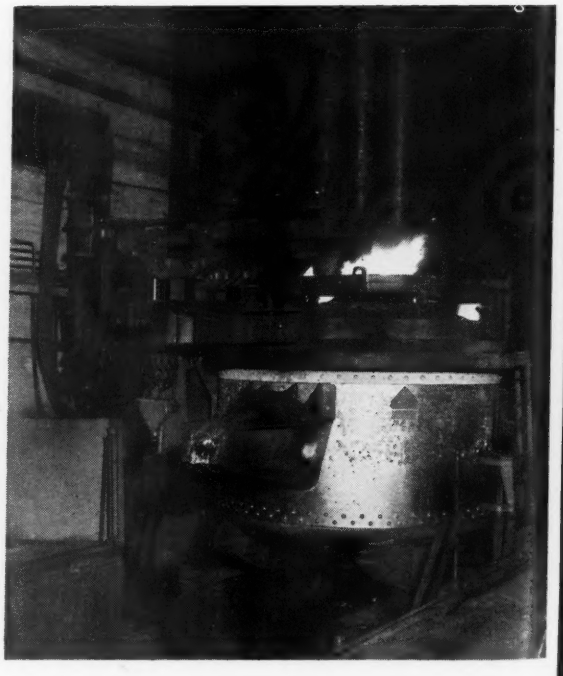
Briefly, the electrodes are attached to pistons, the movements of which are caused by water under pressure, the flow being governed by a valve which is operated by oil pressure on one side and an opposing spring on the other; the variations in the electrode current, caused by the state of the charge and the process of melting, are reflected in a movable magnetic core attached by a rod to a piston controlling the flow. In such a system inertia is negligible. Furnace charging is facilitated by a lift and swing aside roof, loading being carried out by means of a drop-bottom steel charge basket.

In the Clyde Alloy installation miscellaneous charges of mild steel scrap and turnings are used for the eventual production of high quality castings. The average melting time required per charge has been found to be 2·16 hr with a 3 ton charge and although this is maximum nominal capacity, charges of 4·25 tons have been used.

The furnace is rated at 2,000 kVA and is fed through a transformer from a 6·6 kV supply, and the electricity consumed per ton of metal melted is 650 kWh. Graphite electrodes of 8in diameter are employed, 10 lb of electrode being consumed per ton of metal produced.

The hydraulic electrode control is part of a common system providing motive power for tilting the furnace body, lifting and swinging aside the roof and raising the door. A pair of electric pumps are fitted (one spare to ensure continuous operation) in the sump supplying water to the accumulator tank to which is also connected a compressed air bottle. The primary function of the compressed air feed is to damp the pressure oscillations which may occur during operation and to permit lifting the electrodes in the event of failure in the electricity supply to the feed pumps. An interesting feature in regard to ease of working is the method of holding the electrodes in position by means of spring loaded clamps; unclamping is easily accomplished by means of an off-take from the hydraulic pressure system thus reducing to a minimum unpleasant maintenance work on top of the hot furnace lid.

Three-ton arc furnace for steel melting

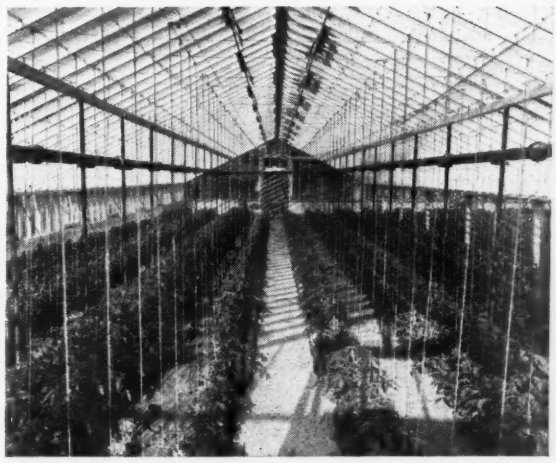


Horticulture in the North West

Success of the Electricity Board's Experiments

IN our 5th November issue, page 715, we described some of the achievements of the North Western Electricity Board in relation to pig rearing, grain and barn hay drying, and dairy farming. To-day we propose to refer to another important branch of the Board's rural activities, horticulture. Under Mr. R. Marshall, the Board's horticultural specialist, this has been the subject of special investigations and experiments and the results are bearing fruit both figuratively and literally, not only in the Board's own horticultural areas around Blackpool and Lakeland, but also throughout the country. The importance of such investigations can be judged when it is realized that by advancing his tomato picking season by four weeks a grower may expect an extra revenue at the rate of about £2,000 per acre.

Although the experiments carried out have been comprehensive, special attention has been paid to soil warming, particularly as supplementary to general heating of growing houses and for propagation. Experience has shown that it is possible to propagate tomato plants satisfactorily at a lower air temperature if electrical bench warming is used. The temperature tried out so far with favourable results has been 52/53 deg F minimum night temperature, instead of 60 deg F which is often employed. In experiments carried out by Mr. Marshall, tomato seed has been sown in early December on warmed benches. Early in February the growing house boilers are lighted and simultaneously the soil warming equipment, loaded at 6/7 W per sq ft of growing area, is switched on. A soil temperature of 58/60 deg F, which is considered satisfactory for planting, is usually reached in 36/48 hours. Electricity consumption varies, of course, with the date of planting and the season, but for raising the soil to the required temperature of 58/60 deg F in February, and keeping this temperature after planting, it is from 3 to 4 kWh per plant. To this should be added about 0·5 kWh per plant for the warmed bench used in raising the plants.

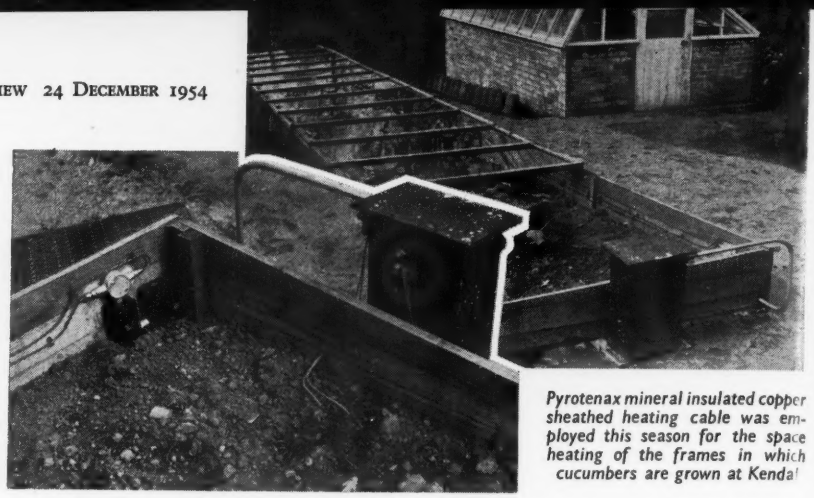


One of the soil-heated tomato houses at Messrs. F. Stephenson & Sons' nursery at Appleby

At the Board's Lakeland Sub-Area offices at Castle

The growing house at the Lakeland Sub-Area's experimental installation at Kendal is arranged so that the three borders can be run at different temperatures. Suspended from the top can be seen the lighting fittings employed for irradiation experiments

The propagating house, shown below, at the North Western Electricity Board's Lakeland Sub-Area experimental installation at Kendal is equipped with thermostatically controlled unit and tubular heaters and heated benches



Pyrotenax mineral insulated copper sheathed heating cable was employed this season for the space heating of the frames in which cucumbers are grown at Kendal

Green, Kendal, a complete model installation has been established. This comprises propagation and growing houses, and frames, fitted with the latest equipment and instruments for recording purposes. Thermostatically controlled unit heaters are used for space heating in both the propagating and growing houses, the latter also being equipped with tubular heaters. Facilities are also provided for experiments in light irradiation. Tomato borders in the growing house are being run for test purposes at different temperatures, and the possibility of restricting the soil warming to night running only is being studied. The soil warming is operated from a 15 V supply provided by 4½ and 2½ kVA transformers. From seed sown the first week in December, tomatoes have been picked in early May.

The growing frames have been used for lettuce, followed by a cucumber crop. Soil warming of the frames is carried out by a G.E.C. 2·5 kVA transformer and space heating is by Pyrotenax mineral insulated copper clad heating cable. This method of electric space heating for frames has already been found of great value to nurserymen when used for protecting from frost plants stored in the frames in winter and early spring. This autumn there were further trials of the unit heaters for the flowering of late chrysanthemums after the tomato crop was cleared.

Altogether in the Board's area about 12,000 sq ft of warmed bench is now in use and several acres of growing houses are equipped with soil warming. One of the leading horticulturalists in the Lakeland Sub-Area, Mr. F. Stephenson, of Banks Nursery, Appleby, is most enthusiastic about the results of soil warming. Besides a propagating house with warmed benches where he raises carnations and chrysanthemums, he has two large adjoining growing houses, which at the appropriate season he uses to accommodate 2,000 tomato plants. The 30 V soil warming wires, which are fed through a 15 kVA "Loheat" transformer, are placed 12–15in below the soil surface. At this nursery the electricity consumption for providing adequate soil temperature for the 2,000 plants a year for four years has amounted to 27,164 kWh, representing a cost of less than 3½d per plant.

We are grateful to the staff of the North Western Electricity Board and to the farmers and horticulturalists whose installations we visited for the help they have given us in the preparation of this and the previous article.

Turbo-Alternator End-Windings

OPENING the discussion on the paper entitled "Short-Circuit Forces on Turbo-Alternator End-Windings" by Messrs. J. B. Young and D. H. Tompsett (*Electrical Review*, 17th December, p. 966) at a meeting of the I.E.E. Supply Section on 15th December, Mr. L. W. James (B.E.A.) said that so far as he was aware, on machines which had passed all their full-voltage short-circuit tests satisfactorily, no troubles had later occurred which could in any way be considered due to the short-circuit tests. Some machines which had never been tested in this way had later broken down due to collapse of windings when subjected to fault short circuits, and the expense and "outage" then necessary to repair the machine was much more serious than that necessary to put in additional bracing and blocking if signs of weakness were shown during the works short-circuit tests. The authors suggested that while such testing was necessary when machines fed local systems at generated voltage, it might no longer be really necessary on the large generator-transformer units now being commissioned. If system or busbar faults were the only troubles to be expected, this might be reasonable, but faults on machines, their connections or the transformer windings still occurred. It was also necessary to have a reasonable margin to take care of deterioration of bracing during 25 years' life.

Mr. W. N. Kilner (Metropolitan-Vickers Electrical Co., Ltd.) said that, in spite of all the experience of the good results of tests, he did not think it was right to carry out these tests on the future larger machines. Manufacturers put in far more insulation than was normally necessary to deal with the ordinary voltage which the windings had to withstand, because they expected the machines to last for 20 or 30 years and knew that some insulation deterioration would take place during that period. If after that had been done a sudden short-circuit test was carried out in the works and there was some damage from that to the insulation, the margin provided would be reduced. If there were to be tests, he strongly recommended that they be done with the windings warm, because then the movement would probably be greater but the damage to the insulation less. He was not in favour of model tests which did not test workmanship.

Mr. F. C. Winfield (Merz & McLellan) said that the authors had attempted to make a mathematical investigation, but "this make-up of wood, string and paper, with part-rigid support and part no support" was an utterly indeterminate mechanical structure, and it was a waste of time trying to do anything except by way of experience, test and practical investigation. The authors' attempt at a model test was a step in that direction.

Mr. W. J. Carfrae (British Thomson-Houston Co.) said he did not think that any manufacturer to-day would be prepared to guarantee a machine against damage in the event of a completely out-of-phase synchronizing, as distinct from a short circuit. The correct procedure would be to take a three-phase short circuit at full voltage on

prototype machines but not on subsequent machines of the same type. Repeated sudden short circuits did not do the windings of a machine any good.

Mr. W. D. Horsley (C. A. Parsons & Co., Ltd.) agreed that there were some grounds for considering whether proving tests should be specified as standard or routine procedure, but the modern alternator was fully capable of withstanding a full-voltage short circuit. In the past many alternators had been short circuited at full voltage, sometimes repeatedly, in order to obtain test data, and subsequent operation had demonstrated that no serious harm had been caused. He did not think it was unreasonable to make a type test on one alternator and to apply a 50 per cent voltage or perhaps a 75 per cent voltage test on other alternators, if only for checking the reactance.

Mr. J. F. Dunn (Kennedy & Donkin) said he was very much in favour of continued testing, but he preferred type testing rather than the testing of machines in service. One type test was to adopt a model arrangement as suggested in the paper, and the other was to put sample windings on a machine which was going into service and then strip it down again afterwards.

Mr. M. Waters (E.R.A.) said that the normal design condition of an alternator allowed the copper to stress well past its elastic limit and also bruised the insulation. If this matter was important, one of the things to aim at was to find some support which would hold the windings in such a way that the stresses in the copper and the insulation could be calculated.

Mr. N. G. McCullagh (Permali, Ltd.) referred to the use of glass in place of string, and materials which were far superior to natural wood for the support brackets. The use of these materials and the amount of design that was going into the structures which supported the end-windings would, he felt sure, lead to great improvements.

The authors replied briefly to the discussion.

ERECTION OF PLANT

Necessity to Observe Building Regulations

By F. E. SUGDEN

THE installation of generating plant and other machinery in power stations or in factories frequently involves the erection of buildings to house the plant. This raises the question of to what extent the contractor is liable under various building regulations.

In a case which recently occupied the attention of the Court of Appeal the plaintiff was a workman employed by the defendants who were under contract to manufacture, deliver and erect four generating plants at a power station which was in the process of construction. The defendants had undertaken to install in each section of a quadripartite structure, a generating plant, floors and galleries connected by stairways and chutes, and boilers and cooling chambers.

The plaintiff with other workmen, was engaged in erecting a chute by means of a pulley and in order to carry out this operation he was standing on an open network of crossed steel joisting. The chute fouled when the pulley became jammed overhead and the plaintiff was ordered to release the pulley. He proceeded to climb up to a higher level of joisting by using the ridges, which ran along the side of the chute, as footholds and handholds. He released the pulley, but while he was descending by the same method, he fell through the open joisting on to a floor below and suffered injuries.

In a claim for damages for personal injuries, he alleged that the defendants were in breach of the Building (Safety, Health and Welfare) Regulations, 1948, Regulation 30 (3), under which joisting is required to be securely covered over to the extent necessary to afford safe access to or foothold for the work. The operations to which those regulations apply are prescribed by Regulation 2 thereof and they include, so far as is relevant in this case, the " construction of a building."

The Court held that the work which the defendants undertook involved part of the operation of the construction of a building within Regulation 2 (1) and therefore the 1948 regulations were applicable. Further the defendants were in breach of Regulation 30 (3) and accordingly the plaintiff was entitled to recover damages.

Naturally the contractor will desire to know the contents of these Regulations; briefly they are as follows:— Regulation 2 (1) includes, *inter alia*, operations undertaken by way of trade or business or for the purpose of any industrial or commercial undertaking, namely the construction, structural alteration, repair or maintenance of a building (including re-pointing, re-decoration and external cleaning of the structure), the demolition of a building, and the preparation for and laying the foundation of, an intended building. This usually applies where persons are employed in such operations.

Regulation 30 (3) stipulates that when work is done on or immediately above open joisting through which a person is liable to fall a distance of more than 6ft 6in the joisting shall be securely covered over by temporary boards or other covering to the extent necessary to afford safe access to or foothold for the work, or that other effective measures shall be taken to prevent persons from falling.

I mention this particular case because if a contractor is not fully conversant with the Regulations, he is liable to commit a breach which will lead to penalties or damages. Thus it behoves the contractor both in the metropolis and in the provinces to familiarize himself with the Regulations, even when, in fact, his primary object is not to erect buildings but to install plant.

Harwell Isotope School

The Harwell Isotope School, which since it was founded in 1951 has had 329 students from 29 different countries, is now preparing its programme for the forthcoming year. Training is given at this school in the applications of radioactive materials in research and industry and in the techniques of producing, measuring and handling such materials. The courses, which last for four weeks, include both lectures and practical work in the laboratory. Students should be graduates of a university. There are vacancies on Course 27, 25th April to 20th May, and Course 28, 27th June to 22nd July. Details of the course fee and further information can be obtained on application to the School, A.E.R.E., Harwell, Berks.

Engineering in Europe

Abstracts from Foreign Technical Journals

THE main direction of the transmission of large powers in Sweden is north–south, at present at the rate of 1,600 MW. An increase to 9,000 MW is planned of which 1,000 MW will be transmitted at 220 kV and 8,000 MW at 380 kV. The long line sections, mostly equipped with twin conductor groups, produce large amounts of reactive power requiring a good deal of compensation by reactors and synchronous condensers at low line loadings. Synchronous condensers are preferable to static parallel capacitors as generators of reactive power at higher line loadings, particularly on account of their superior stability characteristics.

An extension of the zones of stable operation at high powers transmitted is of great economic importance and is achieved by reducing the reactances of alternators, transformers and lines, mainly by grouped conductors (twin) and compensation of the line reactances by series capacitors which so far is very satisfactory; for increased transmitting capacities the conductor groups will have to consist of triple conductors (for the 380 kV lines). The stability in faulted conditions is mainly improved by the use of quick-acting circuit breakers suitable for rapid reclosing, particularly in systems with few branch lines.

The combination of the measures mentioned makes loading of the lines possible up to and beyond the transmitted power rating most favourable from the viewpoint of transmission losses. Every 380 kV line with the planned ultimate 60 per cent compensation will transmit 1,000 MV through triple conductor groups which, without the progressive stabilizing equipment described, would require for the 8,000 MW about sixteen lines instead of the eight planned.—" Stability and Reactive Power in Swedish Transmission Systems," B. G. Rathsmann, *A.S.E. Bull.*, Vol. 45, No. 14, pp. 570–578, 1954, in German.

Cable Fault Location

A comparison of all the known and workable methods of cable fault location is conveniently based on the division of these methods into two groups; viz. relative and absolute methods according to whether the location is by finding the distance of the fault from the point of the measurement, or a direct location without reference point (" geographically "). Numerous tests on h.v. and l.v. cable lines by the following methods: pulse, oscillatory discharge, loop, capacitive, inductive, acoustic and other unspecified methods yielded that among the relative methods the pulse and oscillatory discharge methods for which special equipment was developed by the Central Electrotechnical Laboratory of the U.S.S.R. are very satisfactory, and among the absolute methods the induction system (in which the fault burns itself out and is located by an acoustic detector with an accuracy within $\pm 0{\cdot}5$) and the acoustic method (without burning-out, by acoustic detection of spark discharges) are the recommended ones.

For rapid location, a relative and an absolute method should always be used together, particularly because different methods are differently influenced by line design and have different sensitivities to different kinds of faults, and would therefore mostly supplement each other in the way required. Absolute methods have also the advantage of being independent of the availability and correctness of cable plans, etc. The results of the measurements and the inferences drawn on the relative merits of individual and combined methods could be arrived at in an objective way, despite the fact that minor shortcomings of the equipment provided were established and recommendations for improvements in this respect are made. — " Fault Location in Cable Systems," G. M. Shalyt, *Elekt. Stantsii*, Vol. 25, No. 7, pp. 36–38, 1954, in Russian.

Noise in Synchronous Machines

Owing to their relatively wide air gap, synchronous machines are generally not particularly sensitive to higher harmonics. However, this does not apply equally to all types of synchronous machines, and salient-pole machines without dampers and a small number of slots per pole are definitely unsatisfactory where noise is concerned. Fractional-slot windings are even less satisfactory in this respect, particularly since in unfavourable cases the vibrations set up may produce undue stresses on the mechanical structure of the machine. The author also analyses the possible contribution of the armature reaction to noise production of synchronous machines of salient-pole and smooth-armature types with and without damper windings. It is practically zero.

The very comprehensive investigation described enables not only definite criteria for noise reduction to be given, but also tables for the choice of suitable slot numbers assuring optimum noise reduction. Except for certain cases which are mentioned, non-salient pole machines are less noisy, as is well known.—" Magnetic Causes of the Noise of Synchronous Machines," V. Hamata, *Elektrotech. Obzor*, Vol. 43, No. 9, pp. 460–467, 1954, in Czech.

Elastomers in Cable Insulation

The importance of natural rubber in cable insulation is still considerable, despite the introduction of synthetic rubbers into this field which is bound to belong to them entirely some time in the future. This is due to various facts, among which the most decisive may be that some of the new materials, e.g., neoprene or the copolymer butadiene-styrene have electrical characteristics inferior to those of natural rubber although their mechanical and ageing resistance is better.

More satisfactory insulants include polyethylene chlorosulphonates, lactoprene EV and, above all, silicone rubbers. The latter have quite exceptional dielectric properties and are arc-resistant, although their mechanical characteristics have not been fully developed to the desired values as yet. Also, they are the only materials of this group which cannot be processed by the conventional and convenient methods long satisfactorily operated in cable production; viz. calendering with subsequent longitudinal covering of the conductors by grooved rollers or by extrusion methods. The article contains a considerable amount of information on natural as well as synthetic rubbers on the chemical, physical and technical side and the main trends of their further development.—" Elastomers in Cable Insulation," A. Dehez, *Bull. Sci. Assoc. Ingen. Montefiore*, No. 6, pp. 383–400, 1954, in French.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

ELECTRICAL PROGRESS—1954

Manufacturing Activities of C. A. Parsons & Co., Ltd.

DURING the past twelve months C. A. Parsons & Co., Ltd., have received orders for many large turbo-generators for outputs up to 120 MW to be installed in this country and for export to Australia, Canada, South Africa and Northern Ireland. The 120 MW machines are for the B.E.A. and will operate under reheat conditions, the inlet steam conditions being 1,500 lb/sq in and 1,000 deg F, and reheat after expansion in the h.p. cylinder to 1,000 deg F. The turbines will be of the three cylinder type and will have three exhausts.

Three 60 MW sets have been ordered for the Belfast West municipal power station, two 60 MW sets for Rogerstone power station, and further 60 MW sets for Skelton Grange power station, Yorkshire, and Taaibos power station, South Africa.

A 30 MW two cylinder set ordered by the Saskatchewan Power Corporation will be installed at Saskatoon power station, Canada. Three 20 MW sets ordered by the N.C.B. for No. 4 area will be installed at Grimethorpe, Yorkshire. Two 15 MW sets ordered by the Tamworth City Council for the Guy-Kable power station, Australia, are of particular interest as the condensing plant will be the first to be made by C. A. Parsons of Australia, Ltd., at Whyalla, South Australia.

Orders for a number of turbo-generators to be installed in industrial power houses have also been received. The Thames Board Mills, Ltd., have ordered for their Mersey Works, Warrington, two 6 MW sets, one of which will be of the back pressure type exhausting at 25 lb/sq in gauge, while the other will be of the condensing type arranged for passing out steam at 25 lb/sq in gauge for industrial heating purposes. A 2 MW geared turbine generator ordered by the St. Lawrence Starch Co., Ltd., for Ontario, Canada, will operate at 5,500 r.p.m. geared to the generator at 1,200 r.p.m. The inlet steam conditions are 250 lb/sq in and 506 deg F and to exhaust at 5 lb/sq in gauge. Arrangements will be made for passing out steam after partial expansion at 75 lb/sq in gauge.

During the year many machines have been completed or put into commercial operation. In this country five 60 MW turbo-generators were commissioned, two further sets at Skelton Grange and Keadby power stations, and the first of five machines at Stella South station. Units of 30 MW output were completed at Hackney, East Yelland and Connah's Quay stations. In addition a number of industrial power plants were completed including machines for passing out steam for process purposes, and two turbo-blowers for steelworks.

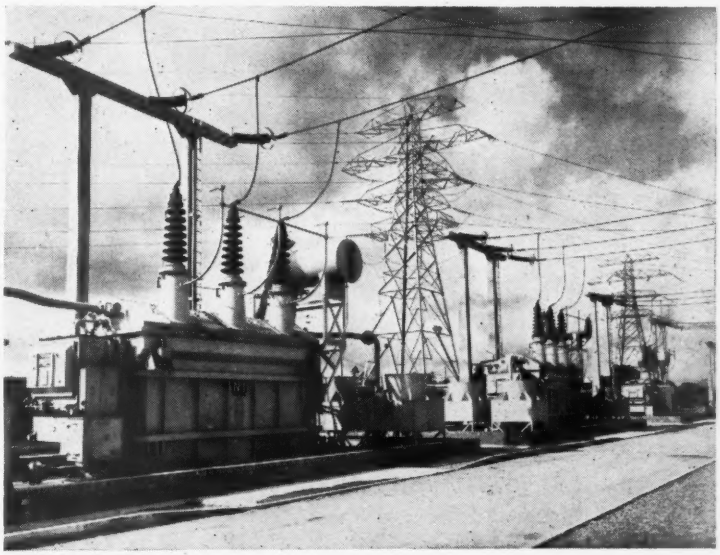
The largest machine completed abroad was a 60 MW set in the Taaibos power station, South Africa. It is the first of eight machines which will eventually be installed in this station. Other machines installed in Canada, Australia, Malaya and Northern Ireland include two 50 MW sets, three 30 MW sets, one 25 MW set, three 20 MW sets and a number of 5 MW sets.

An order has been received for two of the largest double wound transformers ever to be made by the company. It is for two 120 MVA three-phase 50 c/s units to be used for interconnecting the 275 kV and 66 kV systems in the North East of England. The building of new, and extensions to existing, power stations has resulted in a number of orders for transformers for use with turbo-generators. Included in this class are three 72 MVA o.f.w. cooled units for a new power station at Belfast; two 72 MVA units for Skelton Grange "B"; two 75 MVA units for Rogerstone; one 72 MVA transformer for Little Barford, and a sixth 36 MVA unit for East Yelland.

Several orders for large power transformers have been received from abroad, which include three 11 MVA 33 kV, and two 3 MVA 33 kV units for Burma, two 5 MVA 22 kV units fitted with on-load tap changing equipment for South Africa and a 4 MVA 20 kV unit for India. An order has also been received for one 20 MVA 11 kV, and two 10 MVA 11 kV units for Northern Rhodesia.

A number of transformers for use in steelworks are under construction, including two 15 MVA, four 4 MVA and three 3 MVA units. A 3,600 kVA three-phase furnace transformer having on-load tap change equipment has also been ordered. Oil-immersed magnetically shielded reactors made during the year included nine 33 kV single-phase units for the B.E.A., three reactors being connected together to form a three-phase bank having a short circuit reactance of 11 per cent on 30 MVA.

Large transformers put into service in this country last year included two 72 MVA units at Keadby power station; two 36 MVA units at East Yelland power station; two 36 MVA units at Connah's Quay power station, and several 45 MVA units in B.E.A. substations.



Two 36 MVA generator transformers and two 5,000 kVA station transformers at Connah's Quay power station

Domestic Electrical Equipment

Wash Boilers

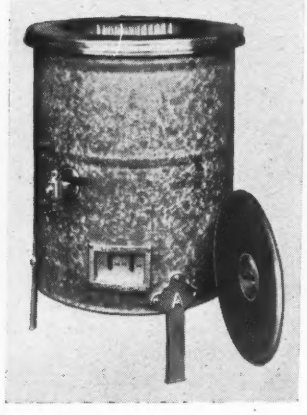
As a means of providing a useful supply of hot water for wash day, both quickly and conveniently, the electric wash boiler is one of the most useful appliances for home laundry purposes; many people prefer to boil their clothes.

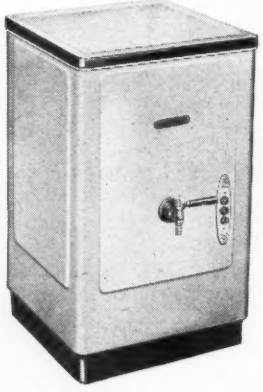
Even the largest wash boilers are transportable and can be stored away when not in use. Many of the new models have an improved appearance and in some cases the top can be used as a table. Several are also available with hand agitators and wringers. The average capacity is 10 gallons and the loading 3 kW.

Use can be made of wash boilers for bottling and sterilizing fruit, boiling puddings, etc. As there is no purchase tax on these appliances the prices are relatively low, ranging from £10 to £12 10s for most models.

Manufacturer	Name or Model	Height, Width and Depth (inches)	Tub Capacity	Agitator	Loading	Method of Control	Exterior Finish	Price
ALDER ELECTRICAL APPLIANCES, LTD. Rushworth Street, Burnley, Lancs.	Alder "XR" Round	27¾ × 19¾ Diameter	10 gal	No	3 kW	Two foot-press switches	Galvanized	£8 17 6
AMPLEC, LTD., Grange Works, Grange Lane, Accrington.	"Wringer Amplewash" Cabinet	36½ × 18½ × 18½	10 gal	Optional extra	3 kW	Hand	Porcelain vitreous enamel	£23 5 0
	"RS/CV" Round	27½ × 19½ Diameter	10 gal	No	3 kW	D/pole 3-heat rotary switch	Cream vitreous porcelain enamel	£11 0 0
	"CRS" Round	27½ × 19½ Diameter	10 gal	No	3 kW	Two foot switches	Galvanized	£8 19 6
	"RJ" Round	27 × 16½ Diameter	8 gal	No	3 kW	Two foot switches	Galvanized	£8 2 0
BRUNLEC APPLIANCES, LTD., Junction Mill, Burnley.	"500" Cabinet	30 × 17 × 17	10 gal	No	3 kW	3-heat push button	Cream or white vitreous enamel	£14 0 0 Cut-out 17s 6d extra
	"540" Round	27 × 19 × 19	10 gal	No	3 kW	3-heat foot-press switch	Cream or white vitreous enamel	£10 10 0 Cut-out 17s 6d extra
	"560" Round	27 × 19 × 19	10 gal	No	3 kW	3-heat foot-press switch	Galvanized	£8 17 6 Cut-out 17s 6d extra
BULPITT & SONS, LTD., Icknield Street, Birmingham, 18.	"600" Round	—	4 gal	Percolating type turbulator	1,800 W	—	Galvanized	£6 10 0
BURCO, LTD., Rose Grove, Burnley.	"350 F" Round	26½ × 16½ Diameter	8 gal	No	2,625 W	Two foot-press switches	Galvanized	£8 2 0
	"375 AS" Round	28 × 17¾ Diameter	10 gal	Yes*	3 kW	3-heat d/p rotary switch	Galvanized	£9 0 0
	"600 AS" Round	28 × 17¾ Diameter	10 gal	Yes*	3 kW	3-heat d/p rotary switch	Galvanized	£10 11 6

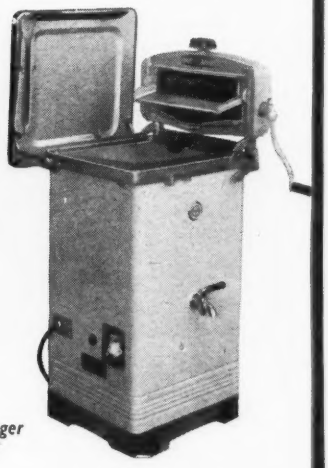
Alder "XR" wash boiler





Brunlec model "500" wash boiler

Burco "375" wash boiler



Right: Amplec "Wringer Amplewash" boiler

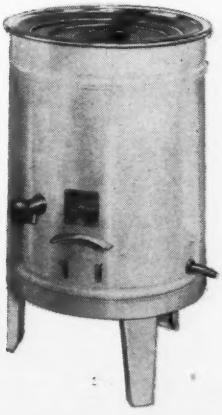
Manufacturer	Name or Model	Height, Width and Depth (inches)	Tub Capacity	Agitator	Loading	Method of Control	Exterior Finish	Price
BURCO, LTD., Rose Grove, Burnley. *(continued)*	"E650 AS" Round	28×17⅞ Diameter	10 gal	Yes*	3 kW	3-heat d/p rotary switch	Enamel	£12 2 3
	"E850 AN" Cabinet	30½×17⅞×21½	10 gal	Yes*	3 kW	3-heat control	Enamel	£16 0 10
	"E950 AN" Cabinet	30½×17⅞×21½	10 gal	Yes†	3 kW	3-heat control	Enamel	£23 5 10
	"763 DX" Round	31⅞×19⅞ Diameter	16 gal	No	4½ kW	3-heat d/p rotary switch	Galvanized	£18 5 3
	*Agitator lid unit type I, £2 5s 6d extra, plus 8s 4d purchase tax. †Agitator lid unit type II, £1 10s 0d extra, plus 5s 6d purchase tax.							Cut-out, all models £1 extra.
CHALFONT ELECTRICAL PRODUCTS, LTD., Tyrell Street, Leicester.	"Popular" Round	18×16 Diameter	4/4½ gal	No	2 kW	—	Galvanized	£3 7 6
GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2.	"DE4753" Round	27×19 Diameter	9½ gal	No	3 kW	S/pole switches	Galvanized steel	£9 8 0
	"DE4754" Round	27×19 Diameter	9½ gal	No	3 kW	D/pole switches	Galvanized steel	£9 15 0
	"DE4755" Round	27×19 Diameter	9½ gal	No	3 kW	D/pole switch and cut-out	Galvanized steel	£10 16 0
	"DE4760" Cabinet	28×16×16	9 gal	No	3 kW	D/pole switch and cut-out	White enamel	£15 0 0
	"DE4755C" Round	27×19 Diameter	9½ gal	No	3 kW	D/pole switch and cut-out	Cream enamel	£15 0 0
L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, Kingsway, London, W.C.2.	"Dinky" Round	12×10½ Diameter	3 gal	No	1½ kW	—	Frosted aluminium	£3 15 0
JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, London, S.W.1.	"D906" Round	27½×17⅞ Diameter	10 gal	No	3 kW	D/pole rotary switch	Galvanized	£9 19 0
	"907" Round	27½×17⅞ Diameter	10 gal	No	3 kW	Automatic cut-out	Galvanized	£11 4 0
	"D906" Round	27½×17⅞ Diameter	10 gal	No	3 kW	D/pole rotary switch	White or cream enamel	£10 10 0
	"907" Round	27½×17⅞ Diameter	10 gal	No	3 kW	Automatic cut-out	White or cream enamel	£11 15 0
MONARCH ELECTRIC, LTD., Vicarage Road, Lye, Worcs.	"Queen" 57A Round	15½×16½ Diameter	4 gal	No	1½ kW	Detachable connector	Galvanized and lacquered	£3 7 6
	"Handiwash" 78B Round	23×16½ Diameter	6 gal	No	2 kW	2-heat switch	Galvanized and lacquered	£5 8 6

Monarch "Handiwash" boiler

Bulpitt "Swan Brand" boiler

Left: Hawkins LGH.1400 "Dinky" boiler

Right: Jackson "907" wash boiler



G.E.C. "DE4760" cabinet wash boiler

Right: Chalfont "Popular" wash boiler

WASH BOILERS . . . . . *continued*

Manufacturer	Name or Model	Height, Width and Depth (inches)	Tub Capacity	Agitator	Loading	Method of Control	Exterior Finish	Price
SAMUEL SIMISTER & CO., Copper & Tin Works, Croston, Bolton.	"No. 5" Cabinet	18½×18½×31	10 gal	No	3 kW	Foot-press switches	Enamelled	£12 15 0
	"Standard" Round	28½×17½ Diameter	10 gal	No	3 kW	Foot-press switches	Galvanized	£9 5 0
	"Competitor" Round	28½×17½ Diameter	8 or 10 gal	No	2½ kW	Foot-press switches	Galvanized	£8 4 6 (8 gal) £8 12 0 (10 gal)
	"No. 7" Round	24×16 Diameter	7½ gal	No	2 kW	Foot-press switches	Galvanized	£7 11 0
HERMAN SMITH SMITHLITE, LTD., Empire Works, Dudley, Worcs.	"G.1953" Round	26×17¾ Diameter	10 gal	No	3 kW	Rotary 3-heat switch	Galvanized	£9 0 0
	"G.1953 S.C." Round	26×17¾ Diameter	10 gal	No	3 kW	Toggle 3-heat switch & cut-out	Galvanized	£10 0 0
	"E.1953" Round	26×17¾ Diameter	10 gal	No	3 kW	Rotary 3-heat switch	Stoved enamel	£10 5 0
	"E.1953 S.C." Round	26×17¾ Diameter	10 gal	No	3 kW	Toggle 3-heat switch & cut-out	Stoved enamel	£11 5 0
SOUTH WALES SWITCHGEAR, LTD., Blackwood, Mon.	"350" Round	27½×18½ Diameter	10 gal	Optional extra	3 kW	Two kick switches	Galvanized	£9 5 0 (s/pole switches) £9 11 0 (d/pole switches) £10 10 0 (a.c. cut-out)
	"351" Round	27½×18½ Diameter	10 gal	Optional extra	3 kW	Two kick switches	White or cream stoved enamel	£11 3 0 (s/pole switches) £11 9 0 (d/pole switches) £12 8 0 (a.c. cut-out)
	"352" Round	27½×18½ Diameter	10 gal	Optional extra	3 kW	Two kick switches	White or cream stoved enamel	£12 6 0 (s/pole switches) £12 12 0 (d/pole switches) £13 11 0 (a.c. cut-out)
F. J. TOMLINSON, LTD., Hall Carr Mill, Rawtenstall, Lancs.	"Handy-Boiler" Round	11×15¾ Diameter	4 gal	No	1½ kW	Ejector safety device	Galvanized	£3 19 6
	"Handy-Pail"	10½×13 Diameter	3 gal	No	1½ kW	Ejector safety device	Galvanized	£2 9 11
UNIVERSAL BOILERS & ENGINEERING CO., LTD., Fulledge Works, Burnley.	"RGAC" and "RGDC" Round	28×19½ Diameter	10 gal	No	3 kW	Rotary switch	Galvanized	£9 0 0 (RGAC) £9 4 8 (RGDC)
	"RGCO" Round	28×19½ Diameter	10 gal	No	3 kW	Two foot-press switches&cut-out	Galvanized	£10 0 0
	"RSAC" and "RSDC" Round	28×19½ Diameter	10 gal	No	3 kW	Rotary switch	Stoved enamel	£10 10 0 (RSAC) £10 14 8 (RSDC)
	"RSCO" Round	28×19½ Diameter	10 gal	No	3 kW	Two foot-press switches&cut-out	Stoved enamel	£11 10 0
	"SQAC" and "SQDC" Cabinet	29½×16×16	10 gal	No	3 kW	Rotary switch	Stoved enamel	£13 15 0 (SQAC) £13 19 8 (SQDC)
	"SQCO" Cabinet	29½×16×16	10 gal	No	3 kW	Two foot-press switches&cut-out	Stoved enamel	£14 15 0

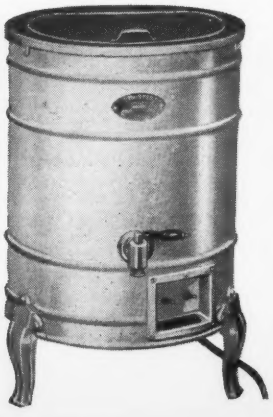
Left: Universal Boilers "Versco" galvanized wash boiler

Below: Tomlinson "Handy-Boiler"

Herman Smith "Smithlite" wash boiler

Right: South Wales Switchgear "352J" wash boiler with agitator

Below: Simister "Standard" electric boiler



VIEWS on the NEWS

By REFLECTOR

I WOULD have thought that any attempt to brighten the dismal stretch of wharves and warehouses on the right bank of the Thames below Waterloo Bridge would have been welcomed. But it was with some difficulty and reservations that one concern was recently given permission to erect a neon sign with 5ft lettering; it was considered by Lambeth Borough Council that 3ft lettering was high enough. The case had been decided in the applicants' favour by the Ministry of Housing and Local Government after an appeal from the Borough Council's refusal of permission. If the South Bank was ever to be properly planned—or rather if plans were ever carried out—there would be a case for stricter control of illuminated signs but as things are at present there is not much justification for it.

* * *

There are signs that the B.E.A.'s North Wales water power proposals may meet with less opposition than was at first expected. Even so eminent a member of the preservation of the countryside movement as Lord Merthyr, a former National Parks Commissioner, has recently declared " I think it is wrong to say of hydro-electric stations 'We will not have them at all.' " According to the *Western Mail* Lord Merthyr, addressing the Herefordshire Branch of the Council for the Preservation of Rural England, said that he had once opposed the building of hydro-electric stations in North Wales but had now altered his mind considerably. He went on to say that there were far too many people who thought that the building of any structure must be opposed, adding " If change makes things more agreeable and adds to the amenities of a place, then let us have it. . . . We must have electricity. The case against these schemes is very much exaggerated and it is a great mistake."

* * *

On the other hand, as reported by the *Manchester Guardian*, the clerk to the Caernarvonshire County Council told a meeting of the Snowdonia National Park Committee that he feared that the prospects of attracting new industries to Snowdonia would be jeopardized if the British Electricity Authority was allowed to " abstract " its water supplies. He said:—

> " This is not purely a question of amenity. We are prepared to sacrifice some of the amenities if the local people will benefit. We'll sell Snowdon itself if we are offered a high enough price."

The B.E.A.'s new Hydro-Electric Bill does not provide for this, but maybe it is a good idea.

* * *

Swiss hydro-electric stations have become part of the scene in that country; little is heard of their being in any way blots on the landscape. This may be attributed to the careful way in which they are sited and built. In the case of the Rheinau plant there seem to have been qualms. Although the work on this station has been in progress for about two years and over £5 million has been spent on it the Swiss Federal Government was pressed to hold a referendum of the entire male population (Swiss women have no vote) to decide whether the Rheinau undertaking should be stopped or proceeded with. In the result two-thirds of the voters were in favour of continuing the construction of the station, which seems to be a wise decision in the circumstances. An adverse vote would have involved the Swiss Government, which had approved the scheme, in claims for damages. Another complication would have arisen from the fact that the Rheinau development is international, German interests being concerned in it.

* * *

Some time ago I deprecated the conversion of adjectives into substantives, e.g., " murals," " musicals," etc., but I had to make an exception of " plastics." Now, I hear, the Council of the British Plastics Federation has decided to encourage the widest use of the terminal " s " in the adjective in accordance with the decision of the British Standards Institution in B.S. 1755, Glossary of Terms. This defines plastics as:—

> " A wide group of solid composite materials which are largely organic, usually based on synthetic resins or upon modified polymers of natural origin and possessing appreciable mechanical strength. At a suitable stage in their manufacture most plastics can be cast, moulded or directly polymerized to shape. Some plastics are rubberlike, while some chemically modified forms of rubber are considered to be Plastics.
>
> " The noun may be used adjectivally to describe an article or substance as being composed of, or as being, a material in the group mentioned in the definition. Used thus the word is distinguished by its terminal 's' from the adjective 'plastic' signifying the susceptibility of a material to plastic deformation."

* * *

Recent articles in this journal on electric furnaces lend interest to a description of the Keller furnace which appeared fifty years ago (*Electrical Review*, 23rd December, 1904). It was said that the furnace:—

> " consists of two square iron chambers lined with refractory material and arranged side by side. The base of each is a carbon block. A horizontal channel connects the bottom of the two chambers, and an external cable brings the two carbon blocks into electrical contact. The electrodes are built up of square carbon rods into square masses 35in in diameter and 55in long. These hang vertically, one in each chamber. The current comes from a 16-pole revolving field alternator, which gives an E.M.F. of 60 volts and a frequency of 50 per second. It passes to one electrode, downward through the charge to the carbon block; thence it goes, either by the external cable, or when the furnace is in full working order, through the fused metal lying in the horizontal passage, to the second block, then upwards through the charge to the second electrode. By this arrangement the furnace can be worked continuously, for there is no interruption of the current when the molten metal is tapped, and excessive variations in the load on the generator are avoided."

* * *

Christmas gives me an opportunity not only of wishing my readers the usual compliments of the season but also of thanking those who have drawn my attention during the year to subjects for comment. I very much value this sort of co-operation.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

The North of Scotland Hydro-Electric Board has appointed **Mr. H. W. Simpson,** at present deputy secretary, to be secretary from next month, and **Mr. J. C. N. Baillie,** development engineer, to be chief commercial officer. Mr. W. D. D. Fenton, the Board's present secretary and commercial engineer, leaves on 20th January to take up his new post of deputy chairman of the Uganda Electricity Board.

Mr. Simpson, who was born in Deskford, Banffshire, was educated at Dunfermline High School and at the University of Edinburgh, where he graduated M.A., LL.B. (with distinction) and thereafter qualified as a solicitor. He became assistant secretary of the North of Scotland Board in 1944 and was appointed deputy secretary in 1948.

Mr. Baillie was born in Coatbridge, Lanarkshire, and received his technical training at Coatbridge Technical College. After service with the Clyde Valley Electrical Power Co. and the Buckrose & South-East Yorkshire Light & Power Co., Ltd., he joined the North of Scotland Board in 1946. He is a member of the Incorporated Sales Managers' Association and the Institution of British Agricultural Engineers (Scottish chairman and member of the National Council).

Mr. D. N. de Mattos, B.Sc., Graduate I.E.E., Graduate I.M.E., has recently moved to Bristol as sub-district manager of the district office of the British Thomson-Houston Co., Ltd. On completing his initial apprenticeship with the B.T.H. Co. in 1942, Mr. de Mattos entered London University, graduating in 1944. Subsequently he served in the R.N.V.R., chiefly in the Far East, returning to Rugby for a post-graduate course in 1947. He was posted to the B.T.H. Manchester office for commercial engineering duties in 1950, and in 1952 was transferred to the company's London office staff in a similar capacity.

Mr. D. N. de Mattos

Mr. B. Barton

Mr. B. Barton, Associate I.E.E., who until recently was on the staff of the B.T.H. Manchester office, now holds a commercial engineering appointment at Crown House, Aldwych, W.C.2.

Mr. E. R. Seaden, B.Sc.(Eng.), Associate I.Mech.E., who for six years has been on the lighting engineering staff of the company, has been posted to the industrial sales division of the B.T.H. London office as a commercial engineer.

Mr. V. Watlington and **Mr. T. W. Heather** have been re-elected chairman and vice-chairman of the Electrical Fair Trading Council for the tenth year in succession. **Mr. C. R. Duncombe** has succeeded Mr. Raymond Berry as representative of the Associated Manufacturers of Domestic Electrical Appliances and **Mr. F. Norris** has taken the place of Mr. W. C. Huston as representative of the Electric Discharge Lamp Auxiliaries Council.

Mr. E. H. Ball, a director of Associated Electrical Industries, Ltd., and managing director of the British Thomson-Houston Co., Ltd., has been elected chairman of Birlec, Ltd., which was recently acquired by A.E.I. Also elected to the board are **Mr. W. W. Vinsen,** director of manufacture (B.T.H. Co.), and **Mr. E. S. Little,** comptroller and secretary (B.T.H. Co.). These three new directors join the existing executive directors, Mr. G. P. Tinker (managing), Mr. T. G. Tanner and Mr. J. H. Crossley.

The Council of the Institute of Metals has made the following awards:—The Institute of Metals (Platinum) Medal for 1955 to **Dr. C. J. Smithells,** M.C., F.I.M., director of research, the British Aluminium Co., Ltd., in recognition of his services to metallurgical science, to the metal industries and to the metallurgical profession; the Rosenhain Medal for 1955 to **Dr. W. A. Baker,** F.I.M., research manager, the British Non-Ferrous Metals Research Association, in recognition of his outstanding contributions to knowledge in the field of physical metallurgy, with special reference to the influences of gases and shrinkage on the soundness of cast metals; and the W. H. A. Robertson Medal and Premium for 1954 to **Professor H. Ford** and **Mr. J. G. Wistreich** for their paper on "Problems of the Control of Dimension, Shape and Finish in the Rolling of Sheet and Strip and in the Drawing of Wire," published in the journal of the Institute.

Mr. E. R. Seaden

Babcock & Wilcox, Ltd., announce that in view of their expanding activities in Latin-America, **Mr. A. S. Peacock** has been appointed as manager for that territory with general responsibility for the company's business in Latin-America, including factory development in Brazil and co-ordination of policy. The appointment takes effect from 1st January.

Mr. J. J. Davies has been appointed publicity manager of Holophane, Ltd. Mr. Davies, who was formerly with W. T. Henley's Telegraph Works Co., Ltd., has had long advertising experience in the manufacturing electrical and agency fields and will be responsible for advertising and public relations, exhibitions and printed matter. He succeeds **Mr. G. A. T. Burdett,** who is leaving Holophane to join the publicity organization of the British Thomson-Houston Co., Ltd.

Mr. J. J. Davies

Mr. G. E. Jewell, a director of the London Electric Wire Co. & Smiths, Ltd., has been re-elected chairman of the Covered Conductors Association for 1955, and **Mr. G. F. Travis,** a director of Connollys (Blackley), Ltd., has been re-elected vice-chairman.

At a board meeting of Electric & Musical Industries, Ltd., held last week **Sir Alexander Aikman** indicated his desire not to stand for re-election as chairman. He will, however, remain on the board. **Mr. J. F. Lockwood** was appointed chairman. Mr. Lockwood is chairman and managing director of Henry Simon, Ltd.

The Minister of Fuel and Power has appointed **Alderman P. W. Barnes,** of Southampton, to be a part-time member of the Southern Electricity Board, and **Sir Charles Bartlett,** of Harpenden, Herts, to be a part-time member of the Eastern Electricity Board.

The following have been elected officers of the Royal Society for the ensuing year:—President, **Dr. E. D. Adrian,** O.M.; treasurer and vice-president, **Sir Thomas Merton;** secretaries and vice-presidents, **Sir Edward Salisbury,** C.B.E., and **Sir David Brunt;** foreign secretary, **Sir Cyril Hinshelwood.**

At the annual general meeting of the British Productivity Council, held

on 15th December, **Mr. Tom Williamson,** C.B.E., J.P., general secretary of the National Union of General and Municipal Workers, concluded his year of office as chairman of the Council, and was succeeded by **Sir Ewart Smith,** technical director of Imperial Chemical Industries, Ltd.

Mr. W. A. Turner, B.Sc.(Eng.), M.I.E.E., has been appointed principal of the School of Electronics which the Automatic Telephone & Electric Co., Ltd., has established at Liverpool. The school will help to meet the company's need for competent research, development, design and production engineers. University graduates and others having the required qualifications will be selected to undergo a full-time course in the school. Mr. Turner held various appointments as a lecturer at educational establishments before going to Brighton Technical College in 1950 as head of the Electrical Engineering Department. He started his career in industry serving an apprenticeship in electrical engineering and thereafter became a design estimating engineer with the British Thomson-Houston Co., Ltd., at Rugby. Mr. Turner is specially interested in servo-mechanisms and has given advanced courses of lectures at several centres.

Mr. W. A. Turner

After fifteen years' service with the Telegraph Construction & Maintenance Co., Ltd., **Mr. F. Leighton,** general works manager, is retiring on 31st December. Mr. Leighton joined Telcon from Aberdare Cables and was appointed to the post of chief buyer. He was appointed works manager in 1945. He has been president of the Telcon Social and Athletic Club for many years and acted as chairman of the Staff Association for some years after its formation.

Mr. F. Leighton

Sir Charles Colston has been compelled for personal reasons to resign from the Independent Television Authority. Sir Charles was formerly chairman and managing director of Hoover, Ltd.

On 13th December at the Savoy Hotel, London, the five millionth Varley coil, a product of **Oliver Pell Control, Ltd.,** was handed over for assembly in an S.U. petrol pump.

Mrs. Elsie Larkin (left) hands the five millionth Varley coil to Mrs. A. Foster while Mr. G. F. N. Oliver, managing director of Oliver Pell Control, Ltd., looks on

The handing over ceremony was performed by Mrs. E. Larkin, who in her many years with Oliver Pell Control, Ltd., has personally wound more than 240,000 Varley coils. Mrs. A. Foster received the coil on behalf of the S.U. Carburetter Co., Ltd., and in return Miss R. Moore handed Mrs. Larkin the 4,999,999th petrol pump made by the S.U. Carburetter Co. as a reminder of the occasion. Mr. G. F. N. Oliver, managing director of Oliver Pell Control, Ltd., spoke of the many years' association between the two companies, and Mr. P. P. Swatman, branch manager of the S.U. Carburetter Co., replied. It was announced that from the New Year Oliver Pell Control, Ltd., will be distributing the products of Hurseal, Ltd., and also the special small motors and large transformers manufactured by the Nelson Engineering Co., Ltd.

Mr. C. Johnson, sales manager for L. G. Hawkins & Co., Ltd., has been appointed a director of the company.

Mr. W. H. Smith has resigned his appointments as managing director of the Falkirk Iron Co., Ltd., and Callendar Abbots Foundry Companies, Ltd., but remains chairman of both concerns. He is succeeded as managing director of these companies by Mr. R. G. Sinclair.

Mr. F. C. Platt, M.M., M.I.E.E., is retiring on 31st December after thirty-three years' service as power engineer with Guest, Keen & Nettlefolds (Midlands), Ltd., Screw Division.

London Transport has announced the following changes in organization in the office of the assistant electrical engineer (generation):—**Mr. J. Collins,** B.Sc.(Eng.), generating station superintendent (Greenwich), has been appointed generating station superintendent (Lots Road), **Mr. W. Ward,** M.Inst.F., generating station superintendent (Neasden), becomes generating station superintendent (Greenwich), and **Mr. G. F. Withers,** M.Inst.F., assistant generating station superintendent (Lots Road), has been appointed generating station superintendent (Neasden).

The annual dance of **Cooke & Ferguson, Ltd.,** Manchester, was held at Belle Vue, Manchester, on 13th December. Over 1,000 employees and guests attended. The managing director, Mr. J. R. Ferguson, awarded a cash prize to Mr. N. Rainford of the Contracts Department for the best suggestion of the year and Mr. W. A. McNeill, the chief engineer, presented the A. J. Bailey annual competition cup, for the best catch in the angling section of the sports and social club, to Mr. J. Hamer of the Pattern Department.

About 320 members of the **Bristol Electric Club** and their guests attended the annual dinner at the Berkeley Café, Bristol, on 6th December, when a cheque for £175 was presented on behalf of the Club by the chairman, Mr. A. E. Hayward, to Mr. A. Nichol, local treasurer of the Electrical Industries Benevolent Association.

OBITUARY

Mr. A. V. Bellamy.—The death occurred on 11th December of Mr. A. V. Bellamy, head of the Publicity Department of D. Napier & Son, Ltd., for over eighteen years. Mr. Bellamy had been with the company since 1936.

Mr. Frederic R. M. de Paula, a director of the Brush Electrical Engineering Co., Ltd., died on 13th December at the age of seventy-two.

WILLS

Col. C. W. D. Rowe, a director of Transformers (Watford), Ltd., who died on 1st July, left £128,562 gross (£127,077 net).

Mr. J. H. Payne, engineer of the Leicester Sub-Area of the East Midlands Electricity Board, who died on 23rd September last, left £6,423 gross (£4,935 net).

Alderman E. A. Hayler, chairman of the Mid-Sussex District Committee of the South Eastern Electricity Consultative Council, who died on 1st August last, left £17,076 gross (£15,744 net).

Mr. W. C. Stevens, general secretary of the Electrical Trades Union, who died on 24th October, left £1,646.

Atomic Energy Equipment

Laurence Scott & Electromotors, Ltd., has received a contract from the United Kingdom Atomic Energy Authority for electrical equipment to a value exceeding £400,000. Delivery will begin in the middle of 1955.

Parliamentary News

IN the House of Commons last week Mr. Gammans, Assistant Postmaster-General, replying to Mr. William Ross, said that no wavelengths had so far been allotted to the Independent Television Authority for Scotland or for Wales.

Mr. Ness Edwards asked the Assistant Postmaster-General to state which wave-lengths had been promised for commercial television transmissions, and for which stations.

Mr. Gammans gave the following information: — London — Vision, 194·75675 Mc/s; sound, 191·27 Mc/s. Lancashire—194·75 and 191·25 Mc/s. Birmingham—189·75 and 186·25 Mc/s. The London and Lancashire stations would both work on Channel 9 of Band III, and nominally would have the same wavelengths. The London wavelength would, however, be slightly "offset"—by 6·75 kc/s for vision and 20 kc/s for sound—to guard against possible interference between the two stations. The figures given for the Birmingham station represented Channel 8.

Rural Supplies in S.W. Scotland

Mr. William Ross asked the Secretary of State for Scotland how many farms in the S.W. Scotland area were still without an electricity supply; what progress had been made in the past year to provide a supply; and what was the expected progress during the current year.

Mr. J. Stuart, Secretary of State for Scotland, said he was informed by the South West Scotland Electricity Board that at 31st October last some 2,250 (or 23 per cent) of the farms in the area were still without an electricity supply; during the year ended 31st March, 1954, an additional 675 farms were connected and the number of connections during the current year was expected to be between 500 and 600, of which some 300 had been connected up to 31st October.

Post Office Engineering Wages

In reply to Mr. John McKay Mr. Gammans said that since 1948 two major pay claims made by the Post Office Engineering Union, as well as a number of minor claims, had been settled without reference to the Civil Service Arbitration Tribunal. In particular, there had been an agreement with the Union within the last few weeks estimated to cost the Post Office £1,700,000 a year. In three other major cases where a claim was taken to the Tribunal the award exceeded the offer, but was substantially lower than the amount claimed.

Mr. McKay asked the Assistant Postmaster-General if he was aware that the Post Office Engineering Union, in connection with claims for an improvement in its members' relative economic standards, was prepared to consider favourably any necessary changes to increase productivity, and if he would consider the matter and notify the Union of his proposals as soon as possible.

Mr. Gammans said that the Union wished to establish a connection between wages and productivity. The principles by which Civil Service wages were determined were at present under review by the Royal Commission on the Civil Service, to whom the Union had put its views. Until the Royal Commission had reported, that matter rested *sub judice*. The Postmaster-General was ready at any time to examine constructive proposals designed to increase productivity.

Purchase Tax on C.R. Tubes

On 16th December Mr. Arthur Lewis asked the Chancellor of the Exchequer if he would state what approaches he had received from the British Radio Valve Manufacturers' Association on the question of purchase tax on television cathode-ray tubes and what was his reply.

Mr. Henry Brooke, Financial Secretary to the Treasury, said that on 9th December a letter had been received by the Chancellor of the Exchequer from the Association asking that the tax should be removed from cathode-ray tubes, and that he should discuss the matter with the Association's representatives, which he was arranging to do on the Chancellor's behalf.

Private Members' Bills

Among the Bills presented by private members of the House of Commons is one from Mr. G. Nabarro—the Clean Air Bill—which seeks to give local authorities powers to establish smokeless zones and smoke control areas, and to require the use of approved types of industrial furnaces and domestic heating appliances for the purpose of securing an abatement of atmospheric pollution.

The Public Service Vehicles (Contract Carriages and Special Facilities) Bill, presented by Mr. E. Short, would empower local authorities to provide full or concessionary travel for old age pensioners, the blind, children, etc. This Bill seeks to generalize powers which the Birmingham Corporation has proposed to embody in a Private Bill as a result of a recent Court decision against the practice.

Electricity in Industry

AN Industrial Development Committee has been appointed by the Council of the British Electrical Development Association "to consider the steps to be taken to foster and develop the use of electricity in industry, and to make recommendations to the Council thereon." At its first meeting at 2, Savoy Hill, London, W.C.2, on 15th December, Mr. L. Howles, chairman of the South Wales Electricity Board, was elected chairman and Mr. J. F. Smith, chief commercial officer, South Wales Electricity Board, was elected vice-chairman.

The other members of the Committee are :—Messrs. V. A. H. Clements, assistant commercial manager, British Electricity Authority; F. C. Fenton, chief commercial officer, London Electricity Board; W. B. Poulter, chief commercial officer, Southern Electricity Board; N. C. Metcalfe, assistant chief commercial officer (tariffs), South Western Electricity Board; E. A. Fowler, chief commercial officer, Eastern Electricity Board; W. J. Watson, section head (industrial supplies), East Midlands; E. H. Hubbard, industrial officer, Midlands Electricity Board; W. B. Parkinson, industrial development officer, Merseyside and North Wales Electricity Board; A. Haselhurst, chief commercial officer, Yorkshire Electricity Board; R. M. Muckart, chief commercial officer's industrial department, North Eastern Electricity Board; A. O. Johnson, chief commercial officer, North Western Electricity Board; J. W. Moule, chief commercial officer, South East Scotland Electricity Board; J. Gogan, chief commercial officer, South West Scotland Electricity Board; and A. W. Ferguson, chief administrative officer, Electricity Board for Northern Ireland.

Representatives of the South Eastern Electricity Board and the North of Scotland Hydro-Electric Board have still to be nominated.

PRICES OF MATERIALS

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Monday last.

ALUMINIUM Ingots	ton £156 0s 0d
COPPER, H.C. Electro	ton £281 0s 0d
Fire Refined 99·70%	ton £280 0s 0d
Fire Refined 99·50%	ton £279 0s 0d
COPPER Tubes ..	lb 2s 8⅜d
Sheet	ton £341 5s 0d
H.C. wire and strip ..	ton £313 15s 0d
LEAD, English ..	ton £103 10s 0d
Foreign	ton £102 0s 0d
MERCURY	flask £110 0s 0d
TIN, block (English) ..	ton £709 10s 0d
ZINC, G.O.B. Foreign	ton £82 5s 0d
Electrolytic	ton £86 5s 0d
BRASS Tubes (solid drawn)	lb 2s 2½d
Sheet	ton £277 5s 0d
Wire	lb 2s 9½d
PHOSPHOR BRONZE Wire	lb 4s 1⅜d
PLATINUM	oz £30 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 26d–26½d

Electrical Measurements

Discussion on I.E.E. Papers

AT a meeting of the Measurements Section of the Institution of Electrical Engineers on 14th December, three papers were presented, summaries of which appeared in last week's issue of the *Electrical Review* (page 966). The subjects dealt with were "An Attracted-Disc Absolute Voltmeter," by Mr. G. W. Bowdler, M.Sc.; "The Use of an Electron Velocity Analyser to Stabilize a 50 kV D.C. Voltage Source to a Few Parts in a Million," by Messrs. M. E. Haine, M.Sc., F.Inst.P., and M. W. Jervis, M.Sc. Tech.; and "A Precision D.C. Stabilizer," by Mr. M. W. Jervis.

In opening the discussion, Professor E. Bradshaw (Manchester College of Technology) said that the three papers had one thing in common and that was an attempt to obtain high precision. The method of designating the accuracy varied: in the stabilizer papers reference was made to a few parts in 10^6 and in the third paper to fractions of 1 per cent. As the accuracies were now so high, it might be more convenient to adopt parts in 10^6 as a criterion because it completed the picture. Mr. Bowdler quite wisely adopted a conservative estimate of the accuracy to be obtained. Dealing with the question of whether the high-working stress should be obtained by gas pressure or by the use of vacuum, the author had instanced the possibility of leaks which made him think that high-pressure gas was the better solution. One would have thought that high-vacuum techniques these days were so well advanced that high vacuum might have had certain advantages. In the paper the permittivity of the gas used was quoted. To ascertain the relative permittivity of the medium involved a measurement; therefore, while not disputing the use of the word "absolute" in the title, it was debatable whether any system was absolute if it involved an intermediate measurement.

Compressed Gas or Vacuum

Mr. R. Davis (N.P.L.) said that when it was decided to build the voltmeter there was much thought as to whether compressed gas or vacuum should be used. With a pressure of about 14 atmospheres in air 100 kV/cm could be obtained and a similar figure could be obtained using the vacuum, but it was the possibility of leaks which gave rise to the decision in favour of compressed gas.

In the absolute voltmeter there were not only uniform fields but also divergent fields, and at the moment there was not much information available concerning the behaviour of high-vacuum and compressed gases in divergent fields. It was his impression, however, that in equipment where compressed gas and vacuum were used together, whenever there was trouble it was usually on the vacuum side.

With regard to the voltmeter being an instrument which enabled one to measure r.m.s. voltages, in a high-voltage laboratory high voltages were generally used to study dielectric strength or breakdown of equipment, and the relevant characteristic was not r.m.s. voltage but peak voltage. It was a serious limitation if one could only measure r.m.s. voltages and Mr. Bowdler might perhaps direct his attention to the design of a suitable peak voltmeter for measuring high voltages.

Mr. F. W. Waterton (Newton Victor) said his experience had shown that Mr. Bowdler's decision to use gas was a good one. There were problems involved in using vacuum for a voltmeter of the type under discussion which were not present when compressed gas was used.

The proposed design of the insulator was interesting. From his own experience with a 700 kV transformer insulated with Arcton 6 at 60 lb/sq in he felt that the design would give trouble at a stress of about 300–350 V/mil where the central conductor passed through the tank wall. Assuming that the drawing was to scale, the radial stress at that point had a maximum value of 550 V/mil. His experience suggested that the clearance at that point required to be considerably increased if Arcton 6 were to be used as the insulating medium. If SF 6 at 60 lb/sq in were used he would expect an improvement of about 15–20 per cent.

The gas insulated and vacuum insulated absolute instruments had one big advantage over the air insulated type, as the corrections to be applied before the reading of the instrument could be interpreted in volts were reduced to the minimum. It seemed a pity therefore to introduce into what could be an essentially simple procedure of weighing the pull on the moving disc such intermediate steps as were used by the author. All the transfers of force from electrostatic pull to magnetic field and from magnetic field to indicating instrument tended to introduce errors, and the system in which the pull on the disc was weighed by means of a chemical balance was by far the simplest and least liable to error.

Choice of Amplifier

Mr. R. D. Watts (H. Tinsley & Co.) said he was surprised that Mr. Jervis had favoured the d.c. chopper amplifier rather than the galvanometer amplifier because from his own experience of both types the galvanometer would have been preferable. The d.c. chopper amplifier could have excellent short-term stability, but experience showed that the stability went off very quickly. He attributed that to the wear of the contacts and to possible metallic dust getting between the contacts. There was also the fact that the ripple which was produced could not be overcome or reduced by the use of feedback and an extra filter was necessary. It was significant that in order to monitor the stability of the d.c. chopper amplifier the author in fact used a galvanometer amplifier in order to test whether the apparatus was working properly. If such a galvanometer amplifier were suitable for monitoring it should be suitable for use in the stabilizer.

Mr. F. S. Edwards (Metropolitan-Vickers) said he noticed that the capacitance of the high-voltage condenser could be calculated from the physical dimensions, but there was always the possibility that the high-voltage capacitor might have capacitance which changed with voltage. Presumably steps were taken to ensure that the condensers did not change with voltage.

Mr. F. C. Widdis (Northampton Polytechnic) said that in using the galvanometer amplifier one was faced with the necessity of removing all the ripple from the supply before putting it in the stabilizing circuit.

The authors made a brief reply in the course of which Mr. Bowdler pointed out that published values of the permittivity of nitrogen at various pressures had been taken and used in the calculations.

LETTERS TO THE EDITOR

Responsibility cannot be accepted for the opinions expressed by correspondents. Letters should bear the writers' names and addresses, not necessarily for publication.

London Board Appointment

YOUR correspondent " E.W." is " shocked " because my Board have appointed for the second time a local government officer as secretary, and he states that we " did not look very far or very hard." It is easy for irresponsible letters of this kind to be written and I am surprised that a paper of your high standing should give even indirect support to the anonymous writers. There are too many of them in our midst. But silence on my part might be misunderstood and so I will reluctantly try to lessen " E.W.'s " nervous distress.

When the first secretary of the L.E.B. was appointed early in 1948 there was an extreme paucity of applicants with the necessary skill and experience for this important position, and we had no hesitation in appointing Mr. W. H. Warhurst, LL.B., a very able man who had had much to do with municipally-owned electricity undertakings. In our view his tenure of office has been a great success.

Before appointing his successor we advertised in the electrical Press, *The Times*, *Daily Telegraph*, *Manchester Guardian* and the journals of four of the leading professions and as a result we received some 130 applications from all over the country. " E.W." may be correct in stating that there are plenty of men in our industry " with first class qualifications " but I must observe that very few of them applied for the position in London, where the cost of living is higher than in the provinces. The secretary of a large public board should have a professional qualification of some kind in addition to considerable ability and experience, whereas some of the applicants for the London post had little more than hope and ambition to support their claims. We should have failed in our duty if we had appointed someone merely because he came from inside the industry.

After many interviews and inquiries my Board were glad to be able to appoint as their new secretary a man of quite outstanding ability; and in doing so they are confident that they served the best interests of electricity consumers in London.

London, E.C.2.

H. J. RANDALL,
Chairman,
London Electricity Board.

Electricity Prices and Investment

LAST year a group of experts of the Organization for European Economic Co-operation undertook a study of electricity prices and their relation to investment in the industry. The results of this investigation, the first of its kind on an international scale, are contained in a report " The Price of Electricity " published by the O.E.E.C., 2, rue André Pascal, Paris, 16e. In an introduction the circumstances affecting the development of electricity supply before and after the war are reviewed, with an outline of the trend of cost of electricity production and future prospects.

The conclusion is arrived at that if the output of electricity is to be brought up to a scale consistent with the economic development of O.E.E.C. countries, the industry should be allowed sufficient freedom to be run on sound economic lines so that the raising of the capital required may be facilitated; and in those countries where the investment of foreign capital is supported by the Government, encouragement should be given to such investment by promoting a rate policy that will produce a commercial yield large enough to give the foreign investor a return comparable with that obtainable on the international capital market. The second part deals with the financial situation of the industry in member countries.

Mexican Preferences

IN its October " Mexican Trade Newsletter " *Intercambio* (the organ of the British Chamber of Commerce in Mexico) included the following:—

" One point that should be kept in mind by the British exporter to Mexico, is that of the American (we use this word as a synonym for the U.S.A.) pattern, the American habit of use and the American technical mentality is predominant in this medium. This is natural enough considering that Mexican territory geographically is a prolongation southward of the land-mass of the U.S.A., which country also is its nearest supplier besides being its outstanding economic influence.

" An industry using electric motors for the distribution, and application of its power, although greatly interested in certain characteristics of European motors specially designed for its technical requirements, at the last moment and under the influence of guiding indications from its board of directors, shies away from a prospective purchase of the overseas equipment that its own technicians would have chosen, and reverts to the specification, and purchase, of the electric power units of previous, habitual, use. . . .

" European electrical equipment is successfully sold here alongside its American counterpart. European textile machinery still is in the ascendant, and trans-atlantic equipment for the various chemical industries is not lacking. European cars are thrusting into this market, although more Continental makes than British of recent date; and in each case success is attending concentrated, and well directed, effort; but such success is the outcome of a carefully planned approach to a market that, whilst naturally predominantly American in its habits, can reveal quite remarkable discernment and comprehension for the European counterparts, when these are skilfully channelled towards it, intelligently presented and painstakingly followed up."

Heavy-Oil Engines

THE report compiled by the Diesel Engine Users' Association on the working costs and performance of heavy-oil engines in 1953 covers 91 returns, of which 71 relate to electric power stations at home and abroad, 18 to waterworks and two to marine installations. It is hoped to include in the next report some results of gas-turbine operation.

Particulars of installations and detailed costs per kWh generated are tabulated for 35 home stations, including ten operated by the B.E.A., with a total installed capacity of 72,897 kW, individual station capacities ranging from 180 to 13,569 kW (Bristol Aeroplane Co.). The stations are divided into four groups; mechanical-injection engines only (52,561 kW); air-blast and mechanical-injection engines (12,556 kW); air-blast injection only (7,780 kW). Cost of fuel oil averaged about £15/ton delivered. Similar data are given for 36 overseas stations containing 141,570 kW with an average fuel cost of £17/ton, and also for waterworks and marine installations. The costs of the generating stations are summarized in the accompanying table.

SUMMARY OF HEAVY-OIL ENGINE PERFORMANCE

Item	Home Stations			Overseas Stations		
	Max.	Min.	Av.	Max.	Min.	Av.
Fuel oil lb/kWh generated ...	1·100	0·522	0·622	0·789	0·392	0·610
Lub. oil rated b.h.p.-hr/gal ...	9,720	526	2,850	7,360	622	2,445
Costs per kWh generated—						
Fuel	1·726	0·665	1·002	1·857	0·143	1·050
Lub. oil	0·221	0·012	0·064	0·295	0·031	0·098
Stores and water	0·187	0·002	0·036	0·070	0·002	0·016
Running wages	7·280	0·019	0·663	1·596	0·043	0·276
Repairs and maintenance ...	2·399	0·008	0·321	0·791	0·037	0·253
Total	9·631	0·897	2·086	3·175	0·449	1·693
Running plant load factor, per cent	27·200	1·000	12·000	52·600	4·800	27·400

INDUSTRIAL NEWS

Engineering Wage Claim

Last week representatives of the Confederation of Shipbuilding and Engineering Unions presented their claim for higher wages in the engineering industry to representatives of the Engineering Employers' Federation.

The demand is for 15s a week increase for skilled workers and 10s for unskilled and it is stated that ultimately this would cover 2¾ million men and cost £100 million a year. In April last increases of between 6s 6d and 8s 6d a week were granted to men in the engineering industry. The present minimum rate for skilled men for a 44 hour week is £7 4s 10d and that for unskilled labour £6 4s 10d.

Similar increases for workers in the shipbuilding and ship-repairing industries have been asked for.

Payment for Holidays

The Industrial Disputes Tribunal has made an award (No. 643, H.M. Stationery Office, 4d) in a claim made by the Electrical Trades Union on behalf of its members employed by members of the National Federated Electrical Association (electrical contracting industry). It rules that the agreement between the parties dated 21st July, 1947, concerning payment for certain bank, statutory and other holidays shall be amended to provide that where the normal working week consists of five days and Christmas Day falls on a Saturday or Sunday, the following Tuesday shall be deemed a paid holiday, and where Boxing Day falls on a Saturday the following Monday shall be deemed to be a paid holiday.

The Tribunal finds that the part of the Union's claim for a revision of the current arrangements applicable to a normal 5½ day working week has not been established. The Union asked that in such a case where Christmas or Boxing Day fell on a Saturday, the day should be recognized as a paid holiday and operatives should be entitled to a full day's pay of 8½ hours.

Rating of Institute of Fuel

A decision of the Lands Tribunal, confirming the ruling of a local valuation court, that the Institute of Fuel was not entitled to exemption from local rates, was upheld by the Court of Appeal on 18th December (Lord Justice Jenkins dissenting).

In giving his judgment (reported in *The Times*) the Master of the Rolls said that the question was whether the Institute, which was a society formed for the purposes of science, was exclusively devoted to that purpose. He held that the Crown was right in contending that it was not. The objects included not only the advancement of the science of fuel technology but also the persuasion of the public to save fuel by using appliances recommended by the Institute, and also the creation of a body of expert advisers of a high professional status.

Lord Justice Jenkins said that the object of the Institute was the promotion of the science of fuel technology and any advantages accruing to members were purely ancillary, not substantive, objects. He would allow the appeal.

Lord Justice Birkett, agreeing with the Master of the Rolls, said that in his view one paragraph of the objects included objects which were commercial and social as well as scientific. Another paragraph included the establishment and upholding of the status of fuel technologists not as merely incidental to the carrying out of scientific objects but as a substantive object in itself.

Leave was given to the Institute to appeal to the House of Lords.

Financing Indian Industrialization

Reference was made in our issue of 10th December to the Industrial Credit and Investment Corporation which has been set up to provide funds for the development of industry by private enterprise in India.

It is now announced that Associated Electrical Industries, Ltd., the English Electric Co., Ltd., and the General Electric Co., Ltd., are joining the British group which is to participate in the Corporation to the extent of 1½ lakhs of rupees (£11,250) each.

Participation of United Kingdom subscribers to the new Corporation was arranged through the Commonwealth Development Finance Company and included the principal insurance companies operating in India, together with the eastern exchange banks and certain industrial organizations having interests in that country. The present announcement makes it clear that the three major heavy engineering companies mentioned above are taking part directly as foundation shareholders in the Corporation, in addition to their indirect interest in that body through their respective shareholdings in the Commonwealth Development Finance Company.

Power for Uganda

A colour film which tells the story of the construction of the Owen Falls hydro-electric scheme for the Uganda Electricity Board was shown at the National Film Theatre, London, last week. Made by Gateway Film Productions, Ltd., it is a factual but impressive record of a great engineering achievement. The film opens with a brief account of the country's industries and the advantages that will be derived from the scheme. The progress of the work is then followed, both on the site and in the factories where the individual pieces of equipment were manufactured, up to the official opening of the project by the Queen last April.

Damage to H.V. Cables

High voltage cables laid at the new Stella North power station near Newcastle-on-Tyne have been found damaged and the police and electricity authorities are investigating the possibility of sabotage. The cables, designed to carry 132 kV, are of the oil-filled type, and the outer casing had been punctured in several places by a sharp instrument. The cables had been placed in their final position and the damage was noticed during a routine inspection. The cables are to be replaced, but the damage will not delay the completion of the station.

Lighting Equipment Tenders

Allegations of price fixing in street lighting equipment are to be reported to the Monopolies Commission by the Wembley Council. It was stated that six out of seven tenders submitted for the supply and erection of street lighting equipment quoted an identical price. Moving the resolution, Alderman G. R. Marshall said that asking for tenders was "an absolute farce." In seconding, Councillor B. Lewis stated that the cost submitted for removing a gas column was £2 3s 2d in each case, and the cost of erecting bracket lamps was £2 12s 8d. Alderman C. H. Smith, chairman of the Highways Committee, said that his Committee felt very strongly about the matter and welcomed the suggestion that the facts should be placed before the Commission.

Alleged Overcharge for Electricity

The British Oxygen Co., Ltd., Hillington Industrial Estate, Glasgow, in the Court of Session, Edinburgh, on 15th December, sued the South West Scotland Electricity Board and the British Electricity Authority for £10,000, alleged to have been overcharged for the supply of electricity to its Hillington works. The company asked the Court to hold that the industrial maximum demand tariff under which the charges were made was illegal, and should be set aside. It asked for a declaration that the South West Scotland Board, exercised undue discrimination against industrial users of electricity metered at or above 6,000 V, contrary to the provisions of the Electricity Act, 1947, Sect. 37 (8). The claim related to the years 1952, 1953, and 1954.

At the first day's hearing it was stated that £10,000 was the amount by which the company believed it had been overcharged in respect of the defendants' failure to differentiate properly between high voltage and low voltage supplies.

The South West Scotland Board maintained that the action was irrelevant and that the charges were made under industrial maximum demand tariffs which it legally fixed in the valid exercises of its statutory powers under the 1947 Act. It also pleaded that the sum sued for was excessive. The B.E.A. adopted the same defences.

The hearing was concluded on 16th December when Lord Hill Watson reserved judgment.

Heavy Road Loads

Last week the House of Lords debated the subject of awkward and heavy loads sent by road. Some speakers suggested that it would be better for some of these loads to be carried by the railways or by sea. Lord Mancroft, for the Government, said that the Government shared the speaker's anxiety and that the Government was looking into the problem.

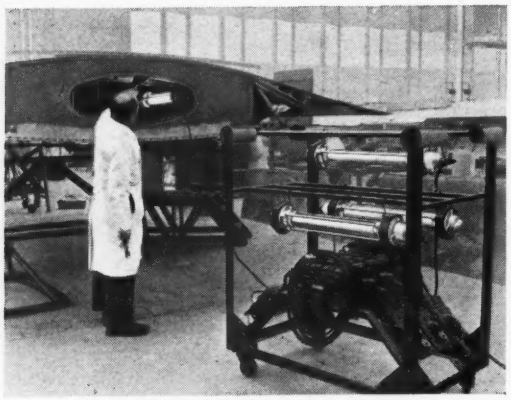
In this connection the British Road Federation has published a booklet—"Round the Mulberry Bush"—explaining why it is necessary that these heavy loads should go by road. Some are indivisible and therefore cannot be handled by the railways. In the case of locomotives and railway coaches for overseas the difference of gauge makes it impossible to run them over our railways.

It is shown that the main cause of the traffic troubles which these heavy loads cause is the out-of-date road system of Great Britain. This also involves roundabout routes and additional time and

expense. Therefore the solution of the problem lies in the modernization of the road system. In the meantime the "elaborate time-wasting regulations governing these important journeys should be overhauled with the aim of simplifying the present cumbersome bureaucratic procedure."

Aircraft Inspection Lighting

A "Mazda" 2ft 40 W flameproof fluorescent fitting for aircraft inspection has been introduced by the British Thomson-Houston Co., Ltd. Specially designed for British European Airways, the fitting is now in use by them in their maintenance workshops at London Airport. Fluorescent lighting was chosen primarily for its low brightness and cool operation which makes it particularly suitable for work in confined spaces, such as inside fuel tanks.



B.T.H. "Mazda" portable fluorescent lamp illuminating the inside of a wing fuel tank in the maintenance shop at London Airport. Control gear is mounted remotely on the movable trolley in the foreground

The fitting consists essentially of two cast aluminium end boxes housing lampholders and a starter switch, connected by three aluminium alloy spacing tubes. An adjustable reflector clips on to the glass cylinder protecting the lamp. Weight has been reduced by mounting the control gear in a flameproof box on a trolley with flameproof switches and plug sockets for six fittings. Oil resisting rubber cable is used. The trolley also provides stowage for up to six fittings.

The equipment was supplied through Newey & Eyre & Co., Ltd., Acton.

E.I.B.A. North Metropolitan Branch

The annual general meeting of the North Metropolitan Branch of the Electrical Industries Benevolent Association will be held on 12th January at Northmet House, Southgate, N.14 (3 p.m.). Nominations for officers for the ensuing year should be submitted to the hon. secretary, Mr. T. Yule, at the above address by 5th January.

Accident at Power Station

An accident at the Plymouth "A" power station at Prince Rock had a sequel at Plymouth magistrates' court on 8th December when the South Western Division of the British Electricity Authority pleaded guilty to having failed to fence securely the junction of a conveyor belt and the drum of a coal-tipping machine at the station as a result of which a workman, Mr. T. W. S. Baker, was injured.

Mr. E. R. Rickard, who prosecuted, said the conveyor belt passed over the drum at a speed of about 250 ft/min, and Mr. Baker had to open a door in the metal casing of the drum and belt and remove coal which had dropped from the belt on to a small platform inside the casing. For that job he had an ordinary domestic hand shovel. As he was using it on 7th September he felt the shovel and then his left arm drawn in between the band and the drum. Fortunately, being a man of sturdy build, and in that case the conveyor band being somewhat slack, he was able with some difficulty to extricate himself, but his left arm was trapped up to the shoulder against the frame of the machine, and he was away from work for seven weeks.

Mr. H. Clarke, of the legal department of the B.E.A., told the Bench that the power station was erected in 1932 by the undertaking's predecessors. There were then no guards, but subsequently the Plymouth Corporation and the B.E.A. had fixed guards.

The door should not have been there. Since the occurrence of the accident an automatic scraper had been fixed to the machine and the belt and drum securely fenced.

In imposing a fine of £15 the presiding magistrate, Mr. R. A. Smith, said the Bench realized that an attempt was made at one time to fence the machine.

Radio Equipment for Ethiopia

A contract was signed on 13th December between the Imperial Board of Telecommunications of Ethiopia and Standard Telephones & Cables, Ltd., and Marconi's Wireless Telegraph Co., Ltd., for a new international radio communications system working from Addis Ababa. The system will provide radio telephone and telegraph communication with London, Nairobi, and important centres in the Middle East. Additional services may be inaugurated later to other European centres.

Standard Telephones' share of the contract includes two 4 kW radio transmitters type DS 12 together with high stability oscillator; telephone terminal equipments providing two simultaneous telephone channels; voice frequency telegraph equipment providing two telegraph channels, and special screened underground cable for linking the radio station sites to the city of Addis Ababa.

A team of British engineers will be installing the equipment during the coming months and training Ethiopian personnel to operate the new stations, which will then be among the most modern and well equipped in the world.

Marconi's Wireless Telegraph Co., Ltd., will supply the complete radio receiving station, in which will be incorporated the latest Marconi types HR.11 (double-diversity) and HR.21 (two-channel independent side-band non-diversity) receivers. In addition, the company will be responsible for the engineering, supplying and installing of the complete aerial systems for both the transmitting and the receiving stations, and also for the supplying of all the independent side-band drive equipment. A considerable quantity of ancillary equipment, including the power units for the transmitting station, the receiving station and the central telegraph office is also to be supplied.

The major part of the power plant associated with the installation (diesel alternator plant and switchgear) is to be supplied by the English Electric Co., Ltd., the remainder being manufactured by Russell, Newbury & Co.

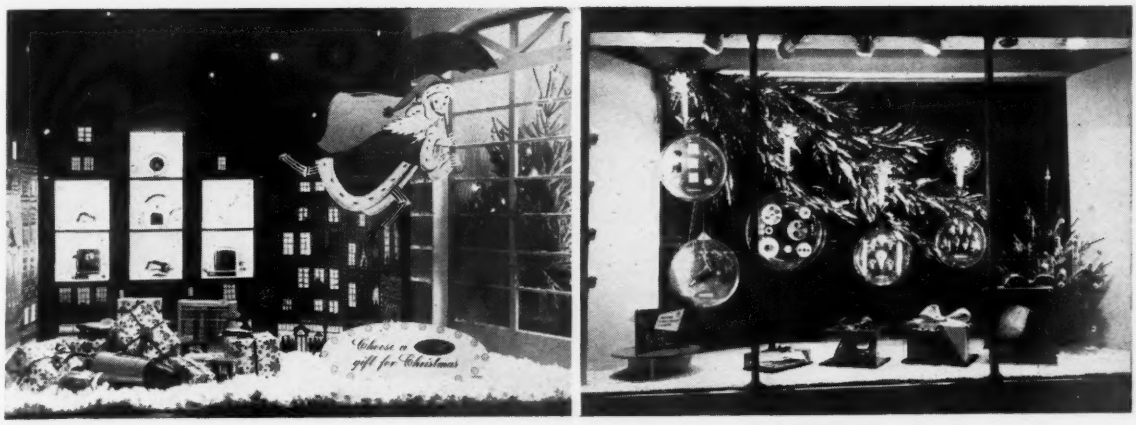
Sign Design Competition

The first illuminated sign design competition to be held in this country, and sponsored by the Electrical Sign Manufacturers' Association, is to be judged by the following panel:—Sir Hugh Casson, Mr. Misha Black (nominated by the Council of Industrial Design), Mr. E. H. Doubleday (president, Town Planning Institute and County Planning Officer for Hertfordshire), Mr. Norman Moore (president, Advertising Association), and Mr. J. H. G. Pearce (chairman, Electrical Sign Manufacturers' Association). Over 1,000 copies of the rules and entry form, and some 400 copies of the perspective drawing and site plan have been sent out by the Association. The competition, which is open to all, has three main purposes: To foster an improvement in the design of illuminated signs; to encourage young designers to take an interest in illuminated sign design technique; and to create a better appreciation of the value and importance of illuminated signs for identification and advertising purposes. The closing date for entries is 31st January next. The prizes (first £100, second £50 and three of £25) will be presented at the E.S.M.A. annual luncheon on 9th March.

Oil-filled Radiator Showrooms

Last week Mr. David Nixon, the television and radio star, officially opened new London showrooms for Dimplex, Ltd., at

The complete range of Dimplex oil-filled radiators is displayed at new showrooms opened in Shepherd Street, London, W.1



Two examples of Christmas electrical displays in London. One of the G.E.C. windows at Magnet House, Kingsway, W.C.2, and (right) the Ediswan display in Charing Cross Road

17, Shepherd Street, W.1. On the back wall of the ground floor above a gallery is displayed the complete range of the company's oil-filled electric radiators from ½ kW to 2 kW in panel and column types in various of the eight finishes available. Downstairs have been arranged representations of a nursery and a bathroom, special attention being drawn to the safety features of the apparatus as well as towel rail attachments. The flameproof type of equipment is also included in the display, together with photographs of various types of radiators in their appropriate domestic settings. Guests at the official opening were welcomed by Mr. E. J. Wade, managing director of the company.

Industrial Management

During the Michaelmas term of 1953 the United Steel Companies, Ltd., provided a panel of speakers for the Faculty Board of Engineering at Cambridge University. The subject was " Industrial Management " and lectures on various aspects were given over a period of seven weeks. In response to many requests these lectures have now been published by the company in book form. Copies are available from the company at 17, Westbourne Road, Sheffield, 10.

Productivity Exhibition

In our last issue we referred to the display of Siemens Brothers & Co., Ltd., at the recent productivity exhibition held at the Woolwich Polytechnic, organized by the British Productivity Council. Other exhibitors included Standard Telephones & Cables, Ltd., C.A.V., Ltd., Elliott Bros. (London), Ltd., and Cinema Television, Ltd., while the London Electricity Board had a display showing how the use of electricity can improve productivity.

Oil-Filled Cables in Johannesburg

The 88 kV oil-filled cables recently installed for the City Council of Johannesburg by Pirelli-General Cable Works, Ltd., are the highest voltage, largest capacity cables yet laid in South Africa. The voltage is the standard transmission voltage of the old Victoria Falls Power Company, operating at 6,000ft above sea level.

The installation comprises a two feeder route, each feeder consisting of three 0·20 sq in single-core cables of conventional design, with a maximum capacity of 40 MVA for each feeder. The route is divided into seven sections of about 560 to 600 yd each. Two telephone cables, two pilot cables and one control cable were laid at the same time.

The route runs from the termination of an 88 kV overhead line at the outskirts of the built-up area of Johannesburg to the Siemert Road substation east of the main commercial centre where the cables are coupled to 80/20 kV transformers via sealing ends.

Christmas Window Displays

Brightness is the chief feature of all window displays at Christmas time and electrical displays are therefore prominent in this respect. Two seasonable examples are shown in the accompanying pictures.

The G.E.C. window display illustrated is one of three at the company's headquarters at Magnet House, Kingsway, London, W.C.2. The painted backcloth is a stylized representation of Magnet House at night, sectioned to show a few household appliances. In the foreground Father Christmas, having filled his sack from a store of presents on the snow-covered ground, is off on his round. The other two windows show reindeer pulling Father Christmas in a sleigh full of presents.

The window display at the head office in Charing Cross Road of the Edison Swan Electric Co., Ltd., is given " theatrical " treatment. The main feature of the display is an outsize Christmas tree branch constructed of metallic paper which scintillates under artificial light. " Perspex " domes, simulating Christmas tree decorations, hang from it with coloured metallic backgrounds carrying selected items from the wide range of products made by the company. " Royal Ediswan " single ended tubular opalized lamps form the candles on the tree and the candle flames are colour sprayed lamps in garland reflectors. Gift boxes of clear " Perspex " containing other of the company's products are arranged at the foot of the tree.

Service Centre Christmas Competition

The Eastern Electricity Board has announced the result of its Christmas Service Centre Display Competition. The Area prizes and trophies have been awarded as follows:—Large service centres, Ware (Northmet Sub-Area); medium service centres, tie between Leighton Buzzard (Chilterns Sub-Area) and Maldon (Essex Sub-Area); and small service centres, Harleston (Suffolk Sub-Area). Winners of Sub-Area prizes are: Aylesbury (Chilterns); Romford (Essex); St. Neots (Fens); Downham Market (Norfolk); Hitchin (Northmet); and Beccles (Suffolk). The initial judging in each Sub-Area was carried out by a panel appointed by the sub-area manager concerned, and the best large, medium and small Service Centres in each Sub-Area were then judged by the headquarters judges, Messrs. H. G. Gamble, C. H. Hardie, and Mrs. R. Messenger. This was the sixth year of the Board's competition, and the judges report that there has been a steady improvement in the standard of display since its inception.

Swansea Third Programme Transmitter

The new Third Programme low-power transmitting station which the B.B.C. has been building at Swansea was brought into operation on 19th December. It has a power of 1 kW and will radiate on a wavelength of 194 metres (1,546 kc/s).

Trade Announcements

Superlamp, Ltd., is opening a new branch and trade counter on 3rd January at 102, Kingsland Road, London, E.2 (telephone: Shoreditch 6061).

From 3rd January the address of **Rota Electric, Ltd.,** will be Hope Hall, Maidenburgh Street, Colchester.

Calendars

A pied woodpecker makes an effective picture for the calendar of the Lindley Thompson Transformer & Service Co., Ltd., which has monthly slips.

The calendar received from the London Electric Wire Co. & Smiths, Ltd., has a picture of the Queen and the Duke of Edinburgh on board the motor launch on the Thames upon their return from their Commonwealth tour. The daily slips bear quotations.

A picture of Knowsley Hall, near Liverpool, has been chosen by the Liverpool Electric Cable Co., Ltd., for its calendar, which has monthly slips showing also the preceding and following months.

" Best of Friends " is the title of the appealing picture of two terriers which surmounts the calendar of the Vactite Wire Co., Ltd. The monthly slips show the preceding and following months.

Canterbury Cathedral makes a dignified picture for the calendar received from Courtney, Pope (Electrical), Ltd. The monthly slips show also the preceding and following months.

"The Dove in Wolfscote Dale" is the title of the picture which adorns the calendar of the D.P. Battery Co., Ltd.

The calendar of Brook Motors, Ltd., has two-monthly sheets, each of which illustrates a section of the company's works.

The 1955 calendar of the Ateliers de Constructions Electriques de Charleroi has monthly sheets bearing pictures in colour of Belgian interiors of the 16th, 17th and 18th centuries.

A lady holding chrysanthemums makes a charming picture for the calendar received from Milne & Longbottom, Ltd.

The neat calendar of Stewarts & Lloyds, Ltd., has monthly sheets and can be used either on the desk or hung on the wall.

"Our Heritage" is again the subject of the C. A. Parsons & Co., Ltd., calendar. It comprises monthly sheets each bearing a beautifully coloured photograph of an English, Welsh or Scottish scene.

Henley Student Manual

The fourth edition of the "Henley Student Manual" has just been issued. With a foreword by Dr. P. Dunsheath, chairman of the Henley Education Committee, the brochure gives a brief history of the company and describes the Henley Education Scheme and the general educational facilities available to employees. It lists educational establishments available and the courses and examinations open to students.

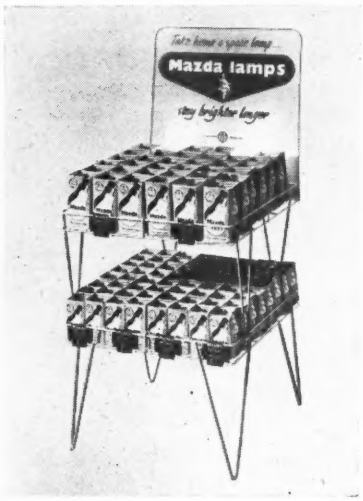
Bolton Training College

It was recently announced in the House of Commons by the Minister of Education, that the Bolton Training College for Technical Teachers would continue and that the necessary capital development would be proceeded with.

Lamp Dispenser

The British Thomson-Houston Co., Ltd., has introduced a new "Mazda" sales aid in the form of a dispenser which holds approximately 100 domestic lamps. The dispenser consists of two wire trays on legs which may be stood on the floor as a unit or separately. It incorporates a three-colour showcard with the caption "Take home a spare lamp, Mazda lamps stay brighter longer," and provision is made for lighted pearl and silverlight lamps for comparative purposes. Tags which give lamp types, wattages and prices clip to the front of each tray. Construction is in heavy gauge wire enamelled yellow.

New "Mazda" floor dispenser which holds approximately 100 domestic lamps



"Metrovick" infra-red plant accelerating paint drying on power press components

Infra-Red Paint Drying

One of the many uses to which electric infra-red plants are being put in many factories, is the acceleration of some existing finishing processes. This frequently results in a better and more durable finish, especially where paint is concerned. In the example illustrated the "Metrovick" infra-red plant is accelerating the drying of an air-drying paint on Black Hawk power press components at the factory of E. P. Barrus, Ltd. The components are mainly castings finished a Post Office red, and the drying takes an average of three to four minutes per component. Standard "Metrovick" infra-red tubular sheathed elements are used, with a total loading of 31·8 kW. The oven is 6ft long, built in two halves, each half mounted on castors to enable the oven width to be varied. Regulators are also fitted to enable infinite variation in heat input. The conveyor is a "Teleflex" 0·705 cable type of rectangular circuit 27ft by 7ft and, to ensure efficient loading, the components are hung on it by means of specially designed jigs.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 1st January:—

FALKS TEATIME. No. B723,528, Class 9. Electric kitchen utensils.—Falk, Stadelmann & Co., Ltd., 91, Farringdon Road, London, E.C.1.

QUAD. No. B731,559, Class 9. Electrical apparatus and instruments for the transmission and reproduction of sound. — Acoustical Manufacturing Co., Ltd., 30, St. Peter's Road, Huntingdon.

COMMODORE. No. 734,486, Class 9. Vacuum cleaning apparatus (electric).—Neptric, Ltd., 73–79, Hurst Street, Birmingham, 5.

VISIOMETER. No. 733,878, Class 9. Scientific apparatus and instruments; electrical apparatus and instruments; and radio, measuring and checking (supervision) apparatus and instruments.—Attwood Statistics, Ltd., Chantrey House, Eccleston Street, London, S.W.1.

PNEUMOTRON. No. 730,538, Class 10 Electrically controlled lung inflating apparatus for use in assisting or promoting respiration.—British Oxygen Co., Ltd., Bridgewater House, Cleveland Row, St. James's, London, S.W.1.

ANDREX. No. B732,079, Class 10. X-ray apparatus and parts, X-ray photographs, devices for protection against X-ray and installations for the production of X-rays.—Holger Andreasen, Copenhagen, Denmark. Address for service, c/o Wildbore & Gibbons, 101, Leadenhall Street, London, E.C.3.

MAGNITE. No. 728,253, Class 17. Electrical insulation materials being steel in sheet or strip form and having an electrical insulation surface.—Steel Co. of Wales, Ltd., Newport Division, Orb Works, Newport, Mon.

CATALOGUES & LISTS

GEAR UNITS.—Leaflet introducing the "Parvalux" S.D.14 single-reduction worm gear unit.—PARVALUX, LTD., Broom Road, Parkstone, Poole, Dorset.

GENERATING SETS.—28-page booklet describing the company's range of petrol, diesel and TVO engines.—PETTERS, LTD., Causeway Works, Staines, Middx.

MAGNETIC SEPARATORS.—Catalogue on the "Magco" type DS high intensity disc separator.—MAGNETIC EQUIPMENT CO., LTD., Lake Works, Portchester, Hants.

SOLENOIDS.—Technical leaflet illustrating the range of Varley "C.M." d.c. push-pull solenoids.—OLIVER PELL CONTROL, LTD., Cambridge Row, Burrage Road, Woolwich, S.E.18.

STEELS.—50-page illustrated catalogue of "Colclad" stainless clad, nickel clad and monel clad steels.—COLVILLES, LTD., 195, West George Street, Glasgow.

Illustrated booklet and reference catalogue for buyers of steel castings.—NORTH BRITISH STEEL FOUNDRY, LTD., Bathgate, nr. Edinburgh.

TRANSFORMERS. — Five loose-leaf pages on current, portable tool and lighting, and technical college transformers for inclusion in the general catalogue.—FOSTER TRANSFORMERS, LTD., South Wimbledon, S.W.19.

WELDING EQUIPMENT. — Technical catalogue relating to electronic controls for resistance welders.—BATES & BATES, LTD., 73, Ashville Avenue, Birmingham, 34.

Leaflet describing the company's latest 300 A oil-cooled welder—Max-Arc "300".—MAX-ARC & ELECTRICS, LTD., Terrace Road, Walton-on-Thames, Surrey.

WIRING ACCESSORIES. — Illustrated priced leaflet on the new Ediswan "Avon" a.c. surface switch socket outlet.—EDISON SWAN ELECTRIC CO., LTD., 155, Charing Cross Road, London, W.C.2.

Japanese Electrical Machinery*

Origin and Growth of the Manufacturing Industry

THE manufacture of heavy-current electrical machinery in Japan goes back to 1884, when the Miyoshi Electric Factory inaugurated the trial manufacture of small generators. Mainly, however, in the initial stage, Japanese production was centred on electrical distribution apparatus, switches, etc. This was due to the small size of most establishments, their low technological standard, and difficulty in obtaining raw materials. Japan's electricity supply companies therefore had to rely exclusively on imported goods for their heavier equipment.

The rapid development of Japan's national economy and the abundance of her water-power resources led to an expansion of the electric power supply industry and the demand for heavy electrical machinery increased as a result. By the end of the first decade of this century, Japan had already become self-sufficient in most of the smaller electrical machinery. It was during this period that the Shibaura Seisakusho (the predecessor of the present Tokyo Shibaura Electric Company), the principal manufacturer of heavy-current electrical machinery since the late 'eighties, succeeded in obtaining technical assistance from the General Electric Co., U.S.A., and started on the expansion of its manufacturing facilities.

During this period, the Mitsubishi Denki Seisakusho (now the Mitsubishi Electrical Mfg. Co.) was established as an independent company. About the same time, the electrical repair shop of the Hitachi Mining Co. was incorporated as Hitachi Seisakusho. These companies produced goods not only for their affiliates, but also for the general public. Thus, by the entry of Zaibatsu-controlled large firms, the structure of the Japanese electrical machinery industry was rapidly built up.

Manufacturers' Overseas Affiliations

A phenomenal expansion of this industry took place during the boom following the outbreak of the 1914–18 war. Taking advantage of the cessation of imports, the industry started to produce large electrical machinery and a considerable part of the output was exported to Asiatic countries. After that war foreign capital was introduced and there were technical affiliations with foreign manufacturers. For instance, in 1923, the Mitsubishi Electric Mfg. Co. obtained technological assistance from the Westinghouse Electric Co., U.S.A., and in the same year the Fuji Electric Mfg. Co. was established as a joint enterprise of the Furukawa Electric Industry Co. and Siemens-Schuckert, Berlin.

Production was more and more concentrated in the hands of the "Big Six," viz., Tokyo Shibaura Electric, Mitsubishi Electric, Hitachi, Fuji Electric, Yasukawa, and Meidensha; in 1953 these companies accounted for 60 per cent of the total output. Although exports were made to Manchuria, China and other Asiatic territories, most of the output was sold in the home market, with demand coming mainly from the electric power companies, which were engaged in carrying out a large develoment programme during this period.

When Japan went to war against China, in 1937, the industry was enjoying brisk conditions because of its preferential treatment in the allocation of raw materials. When the Japanese economy was concentrated on the production of weapons after Japan's attack on Pearl Harbour and her entry into the 1939–45 war, many electrical machinery makers turned to the production of electrical goods needed for war purposes and even to armaments manufacture with the result that output of heavy-current electrical machinery dropped rapidly until the end of that war. Since affiliations with foreign manufacturers were impossible, there was a decline in the technological level of the goods produced.

The output was valued in 1945 at £1,424,641 against £632,325 in 1942, £462,711 in 1939, £82,499 in 1933 and £9,028 in 1914.

Post-War Expansion

Production in the early post-war years fell to an insignificant level because of the much reduced industrial activity, the excess supply of electric power, the prolonged reorganization of Japanese industry under the Zaibatsu dissolution and the economic "democratization" programmes.

The post-war value of the output of this industry (in millions of yen) developed as follows: 1947, 3,166; 1948, 9,427; 1949, 17,382; 1950, 19,782; 1951, 46,055; 1952, 63,801; and 1953, 84,032. These figures include household and non-industrial electrical appliances. (£1=about 1,000 yen.)

VALUE OF OUTPUT OF HEAVY ELECTRICAL MACHINERY IN JAPAN

Class	1951 £ thousands	1952 £ thousands	1953 £ thousands
D.c. apparatus, incl. d.c. generators ...	2,994	4,530	4,922
A.c. generators	1,658	5,997	9,852
Universal electric motors	7,277	9,762	9,175
Other electric motors	5,895	2,807	8,854
Rotary convertors, etc.	1,197	3,828	2,380
Standard transformers	3,777	2,807	3,534
Power transmission and distribution transformers	2,855	5,168	6,461
Other instrument transformers and special transformers	1,105	2,105	2,596
Induction voltage regulators	276	319	389
Rectifiers	967	1,148	1,729
Condensers	1,197	1,659	2,897
Circuit breakers	1,428	2,680	3,608
Switches	6,724	8,358	10,430
Controllers	1,750	2,361	4,124
Electric welding equipment	691	957	1,138
Appliances with built-in motors	1,566	1,595	1,480
Household and non-industrial appliances	4,698	7,720	10,463
Total ...	46,055	63,801	84,032

In the early post-war period, about 45 per cent of the output was accounted for by non-industrial items, chiefly electric heaters and small motors. There was practically no production of generators, large transformers and other plant used for power generation and transmission. The ratio of heavy machinery to total production of all kinds of machinery was only 4 per cent in 1947 and 5·1 per cent in 1948. Production picked up somewhat in 1949 and the ratio rose to 6·2 per cent. In 1950, despite the Korean war boom, output remained at about the same level as in 1949. From 1951 onwards there was a sharp increase in the demand for heavy electrical machinery under the

* Based on a survey of "The Heavy-Current Electrical Machinery Industry of Japan" contained in the *Survey of Japanese Finance and Industry*, Vol. VI, No. 4, published by the Industrial Bank of Japan, Tokyo.

five-year electric power development programme. In addition, there was an increased demand for large and small electric motors under the impact of active investment in equipment stimulated by the general prosperity following the outbreak of the Korean war. Production rose by 133 per cent as compared with the previous year and increased further by 38 and 28 per cent respectively in 1952 and 1953. The above-mentioned production ratio for these three years was 9·8, 12·4 and 10·6 in 1953, thus closely approaching the pre-war ratio of 11·2 for the years 1934–36 (see table on previous page).

Exports of heavy electrical equipment played a minor role in pre-war years because markets were restricted in many cases to the countries of South-East Asia as one of the conditions for foreign technical assistance and, secondly, there was little need to enter foreign markets because of the stable domestic demand as a result of the rapidly developing power supply industry. Exports went to Korea, Formosa, India, Pakistan and Okinawa and consisted, in the main, of small generators and motors, electric heaters, transformers and switches. The Korean war, which led to a sharp rise in raw material prices, failed to produce higher exports.

Export Policy

Manufacturers have recently given serious consideration to measures for the promotion of exports, e.g., the adoption of special prices for raw materials going into export products, and improved export financing. The importance of exports will be enhanced with the completion of the electric power development programme which is likely to result in a rapid fall in the domestic demand for equipment.

Three important features of this industry were referred to above, viz., concentration of production in the hands of large makers; capital participation by the Zaibatsu interests; and technological affiliations with leading foreign companies. What is the post-war situation in respect of these three features?

One of the most striking changes relates to the size of plant. While in 1935 small works, employing from 5 to 50 workers, represented 522 out of a total of 577, their number had fallen to 207 out of a total of 449 by March, 1953. On the other hand, the number of works with more than 1,000 workers had risen from 5 to 32, of which 16 were specialist firms. Even more pronounced was the increase in the number of medium-sized enterprises (51 to 200 workers), from 36 to 143.

In terms of output, large works employing 500 persons and over accounted for more than 70 per cent of the total pre-war output, thus giving rise to an excessive concentration. This trend has not been altered through the war and post-war changes and, in fact, concentration of production in the hands of the " Big Six " appears to have increased over the pre-war level of 60 per cent.

Spread of Production

An analysis of production by individual items shows that the production ratios of the large makers are not necessarily large for such items as standard transformers, industrial electrical machinery and electrical household appliances and that even amongst the large producers there is a considerable difference in the degree of emphasis given to the production of particular items.

Since the dissolution of the Zaibatsu under the occupation directives most of the major companies in the industry have been owned by a large number of stockholders, with large holdings in the hands of the banks, insurance and security companies.

After the war, having lost their past accumulation of capital, and having been obliged to sever their connections with the Zaibatsu interests, Japan's large companies strengthened their connections with large financial institutions; this applies not only to stock ownership, but also to lending and personnel matters. Thus, financial institutions have generally replaced the Zaibatsu as active industrial participants. In the case of the heavy electrical machinery industry, there exists a very close relationship with those financial institutions with which the firms already maintained pre-war connections. Relationships between Tokyo Shibaura Electric and the Mitsui Bank, between Hitachi and the Industrial Bank of Japan, Mitsubishi Electric and the Mitsubishi Bank, Fuji Electric and the Dai-ichi Bank, and Meidensha and the Industrial Bank of Japan are admitted to be nothing but conversions of pre-war links with various Zaibatsu interests. It is thus correct to say that the pre-war Zaibatsu relationships (which the American occupation authorities attempted to eliminate) have been continued in a changed form in the post-war period.

Companies which before the war had affiliations with leading foreign electrical equipment makers tried to revive these as soon as possible after the war. Beginning with the revival, in March, 1951, of the connection between Mitsubishi Electric and Westinghouse Electric, affiliations between Tokyo Shibaura Electric and General Electric were renewed in June, 1951, and between Fuji Electric and Siemens-Schuckert in June, 1952. Companies which formerly had no such links have now established connections with foreign firms, e.g., Hitachi with General Electric, and Dengyosha with Morgan Smith; moreover, certain firms have entered into relations with more than one foreign concern.

Power Development Plan

The future of this important Japanese industry will depend to a marked degree on the electric power development plan, which has, in fact, been the principal factor responsible for the industry's present prosperity. Power development under the five-year electric power development plan reached its peak in the fiscal year 1953 and will gradually decline until the fiscal year 1955, after which it will sharply fall off. Up to now, the plan has been carried out according to schedule, but with the present monetary policy of the Japanese Government, it is being doubted whether the plan can be carried out as intended in the current fiscal year and thereafter. It is reported that the greater part of the demand in the fiscal year 1954 has shifted from generating to transmission and distribution equipment.

As demand and supply of electric power in Japan are expected to be balanced upon the completion of the current five-year plan, it is not anticipated that a second plan will be carried out. In these circumstances, a sharp drop in demand for heavy electrical equipment is expected. The principal makers are, therefore, making an effort to develop export markets and, at the same time, they are planning to produce other products, such as washing machines, refrigerators, radio and television receivers, vacuum tubes, ultra-short-wave communication apparatus, fluorescent lamps, dry batteries, etc., the demand for all of which is increasing rapidly.

It appears, therefore, that makers of heavy electrical equipment are likely to become also manufacturers of consuming appliances, production of which has so far been in the hands of small and medium-sized enterprises. Last, but not least, Japan's electrical equipment makers will endeavour to penetrate foreign markets, at any rate the underdeveloped Asiatic countries, to a much greater extent than in the past.

EARTHING

A Device for Assessing the Effectiveness of Earth Connections

By MANORANJAN DATTA, Ph.D.

HAZARDS arising from faulty earthing are common. To provide adequate protection against dangerous shock, effective earthing of consumers' installations is required by official regulations, according to which "earthed" means connected with the general mass of earth in such a manner as to ensure at all times an "immediate discharge of energy without danger." The latter condition is dependent upon a low resistance (*a*) between the earth electrode and the general earth-mass, and (*b*) within the earthing system itself.

A potential of 30 V is dangerous to humans: therefore in order to render safe any metal not intended as a conductor, it should not become charged to more than 30 V to earth. The resistance of the earthing system should not, in the simplest case, exceed 30/I ohms, where I is the tripping or fusing current. Thus for protective gear rated at 15 A or more, the earth system must have a total resistance of 2 ohms or less. Such a low resistance is difficult to secure and to maintain.

In Fig. 1, if the supply voltage is V and the current rating of the fuse or circuit-breaker is I, then for the protective device to operate $(R_a + R_e) = V/I$, and earthing resistance for a limiting voltage V_e is $R_e = V_e/I$.

In India the most common method of earthing the steelwork of line poles, transformers, etc., is by using cast-iron earth plates, 18in square and $\frac{3}{4}$in thick, buried at a depth of 5 to 6ft. The plates may be embedded in crushed coke.

Other forms are driven pipes and buried strips. Strip and plate electrodes demand excavation work. Higgs[1] has shown that pipes and strips are both more effective than plates, a conclusion that has been confirmed in India. For this reason the types of electrode listed below are recommended for small factory and domestic installations: (*a*) Perforated galvanized tube, 8ft long and $1\frac{1}{2}$in diameter. It is easily installed and lends itself to subsequent treatment with brine to improve earth conductivity. (*b*) Mild-steel spike, 8ft long and $1\frac{1}{8}$in diameter. This is easiest to install on consumers' premises where space is restricted. Such electrodes can be driven to depths of 6–8ft in a few minutes, except where the subsoil is rocky.

Test Results for Electrodes

The resistance R of a single pipe or rod has been found[2] to conform with the relation

$$R = (\rho/83) \log (48L/d) \text{ ohms},$$

where ρ is the soil resistivity, ohm-cm; L is the electrode length, ft; and d is the electrode diameter, in. The inset graph in Fig. 2, obtained from a series of measurements, shows that, for the electrodes (*a*) and (*b*) above, depths exceeding 8ft do not materially reduce the resistance for a given soil, and that the soil resistivity is a principal factor.

The main part of Fig. 2 gives the results of experiments with a number of electrodes in parallel, to determine the reduction of resistance obtainable. Considerable improvement can be achieved, provided that the electrodes are driven in at spacings not less than their depth of setting.

When an earth electrode is associated with a circuit having substantially instantaneous trips or fuses, the maximum allowable resistance is found from (phase voltage/tripping current). If earth-fault currents are likely to persist, however, before being interrupted, it must be remembered that the earth-electrode system rapidly deteriorates with the consequent temperature rise. The fault current carrying capacity of an electrode can be found approximately[2] from the expression

$$T = 2{,}400\ A/\rho\ I^2 \text{ sec},$$

where T is the time during which the fault persists, sec; I is the current loading of the electrode, amp; A is the surface area, in^2; and ρ is the soil resistivity, ohm-cm. Thus in soil of resistivity 1,550 ohm-cm, a rod 8ft long and $\frac{5}{8}$in diameter will carry about 40 A for 10 sec: four 16ft rods would be necessary for, say, 300 A persisting for 10 sec.

Earthing Resistance Measurements

The most usual methods are (i) by voltmeter and ammeter, (ii) by ohmmeter, (iii) by a "Megger" tester, and

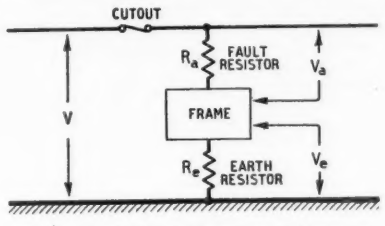


Fig. 1.—Earth circuit resistances and voltages

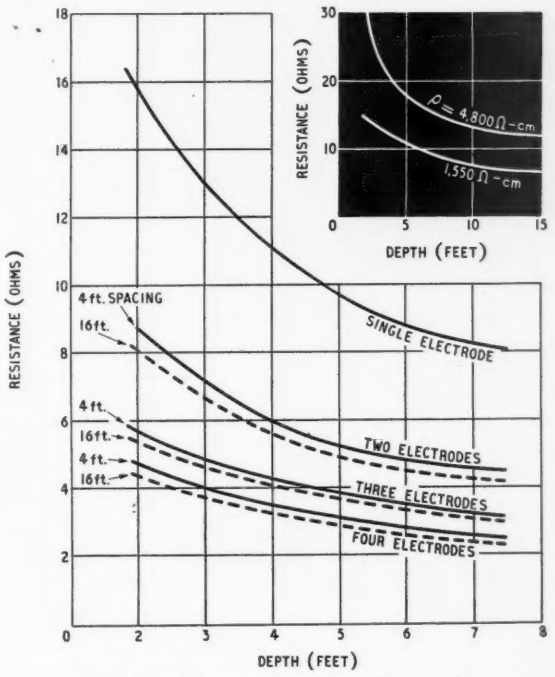


Fig. 2.—Earth resistance of tube and spike electrodes and (inset) resistance of simple tube or spike as affected by soil resistivity

(iv) by null method. All are open to the objection that no indication is given of the ability of the fault path to carry sustained current, nor is the potential of " earthed " metal specifically shown.

Referring to Fig. 1, suppose that the phase voltage V be imposed on the apparatus through a resistance R_a: then the frame will have a potential $V_e = V\ (R_e/R_a)/[1 + (R_e/R_a)]$, and the current will be $I = V/(R_a + R_e)$. For a voltage $V_e = 30$ V, a series of five values of R_a will cater for all likely values of R_e between 4 and 100 ohms, as shown in the table: the supply phase voltage is 230 V.

No.	Test resistor value, R_a ohms	Resistance of apparatus to " earth," ohms, for $V_e = 30$ V	Current rating of R_a, amp
5	42	6·3	5
4	84	12·6	2·5
3	168	25·2	1·3
2	336	50·3	0·7
1	672	100	0·3

An equipment incorporating this method is shown in Fig. 3. It comprises an insulated box, housing five test resistors and a 60 V high-impedance voltmeter, all mounted in a portable case. Extension leads are used for connection to phase, neutral and apparatus frame by means of crocodile clips. After connection, and with the control switch on, the selector prod is tapped on to the test-resistor plugs, starting at No. 1, until a reading of 30 V is obtained on the voltmeter. If no plug results in a reading below 30 V, the resistance of the earth system will have to be lowered, or an earth-leakage circuit-breaker installed. The testing time is a matter of a few minutes.

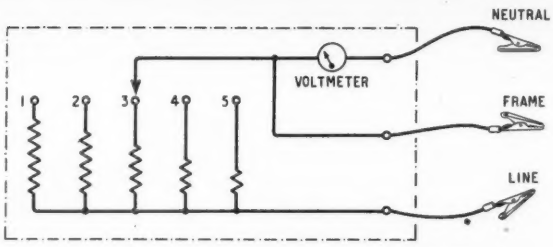


Fig. 3.—Circuit and connections of a simple earth tester

For a supply voltage of 230 V and using tap No. 4 (84 ohms), the voltmeter reading can be converted into terms of maximum copper fuse gauge for a given installation. Thus if the resistance R_e is 23 ohms, a test will indicate a voltmeter reading of 49·5 V, which from simple calculation gives 10 A as the maximum allowable fusing current (i.e. 33 s.w.g.), and the voltmeter could be so marked.

References

[1] Higgs: " An Investigation of Earthing Resistances," *Journ. I.E.E.*, 68, p. 736 (1930).

[2] Fawssett, Grimmitt, Taylor and Shotter: " Practical Aspects of Earthing," *Journ. I.E.E.*, 87, p. 357 (1940).

Swiss Electrical Exports

Slight Overall Reduction in 1953

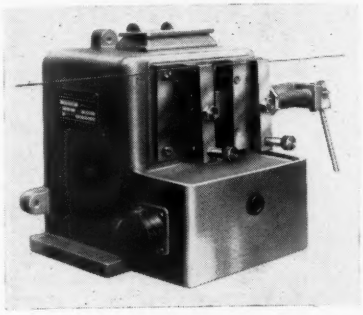
LAST year Switzerland's leading electrical export, dynamo-electric machinery, fell off slightly in value and there were declines also in telegraph and telephone apparatus and lighting and starting equipment. Offsetting this downward trend there were increases in radio goods, accumulators and a considerable range of unspecified electrical apparatus. The diversity of the Swiss electrical export trade was again well marked, as will be seen from the accompanying table showing the values of the principal classes of equipment exported and leading destinations last year, together with notes of increases and decreases on the previous year. (Sw. fr. 12–12½ = £1.)

Class of Equipment	1953 Sw. fr. (000)	Inc. or dec. on 1952 Sw. fr. (000)
Accumulators	4,221	+ 591
To France	357	− 301
,, Germany	532	+ 153
,, Netherlands	291	+ 16
,, Finland	339	+ 37
Insulators	3,800	+ 192
To Belgium	415	+ 114
,, Netherlands	534	+ 20
,, U.K.	587	+ 53
,, Italy	520	+ 374
Meters and measuring instruments	27,523	− 1,299
To France	2,565	+ 1,149
,, Italy	3,670	+ 1,054
,, Belgium	2,422	− 228
,, Netherlands	2,204	− 866
Dynamo-electric machines	109,921	− 1,155
To France	10,957	+ 2,620
,, Germany	3,999	− 738
,, Spain	8,350	+ 3,187
,, Yugoslavia	4,161	− 5,066
,, Czechoslovakia	306	− 2,483
,, Belgium	4,687	− 4,960
,, Finland	2,486	+ 1,017
,, Netherlands	5,224	− 74
,, Denmark	2,903	− 3,846
,, Norway	3,216	− 791
,, Argentina	600	− 394
,, Mexico	3,724	− 474
,, Brazil	6,496	− 1,268
,, Peru	2,330	+ 1,084
,, Portugal	2,446	+ 1,418
,, India	3,473	+ 826
,, Israel	1,293	− 205
,, New Zealand	3,538	+ 3,537
Electric incandescent lamps	447	− 134
To Germany	189	− 36
Lighting and starting equipment for vehicles	5,522	− 898
To France	1,084	− 122
,, Italy	795	− 160
,, Belgium	484	− 159
,, Netherlands	1,011	+ 432
,, U.K.	229	− 168
Telegraph and telephone apparatus	7,787	− 695
To Netherlands	3,429	− 498
,, Israel	296	− 241
,, Italy	510	+ 113
,, Spain	69	− 312
,, Sweden	553	+ 164
Radio apparatus	18,235	+ 4,303
To Germany	1,727	+ 510
,, Italy	5,407	+ 3,732
,, Belgium	641	− 1,801
,, Netherlands	910	+ 210
,, Hungary	225	− 784
,, France	1,008	+ 576
Unspecified electrical apparatus over 500 kg.	34,726	+ 6,651
To Netherlands	1,522	+ 270
,, Norway	1,099	− 406
,, Spain	813	− 1,816
,, Sweden	4,081	+ 706
,, France	883	− 2,116
,, Belgium	930	+ 78
,, Ireland	1,747	+ 156
,, Yugoslavia	74	− 1,524
,, Argentina	30	− 466
,, Brazil	1,303	+ 429
,, Canada	2,077	+ 826
,, Finland	2,613	+ 1,991
,, Turkey	1,099	+ 730
,, U.S.A.	1,982	+ 1,602
Ditto, 50 to 500 kg.	23,609	− 1,349
To Belgium	1,205	− 581
,, Germany	943	− 102
,, Netherlands	1,272	− 130
,, Poland	435	+ 111
,, France	1,289	− 140
,, Norway	1 152	+ 3
,, Ireland	660	+ 50
,, Israel	422	− 574
,, Yugoslavia	383	− 1,792
,, Brazil	1,224	− 434
,, Sweden	1,441	+ 211
,, Finland	1,400	+ 790
Ditto, 3 to 50 kg.	25,490	− 449
To France	2,502	+ 178
,, Belgium	1,860	− 850
,, Norway	779	− 354
,, Netherlands	2,480	+ 174
,, Spain	887	− 253
,, Italy	1,780	+ 316
,, Germany	2,053	+ 435
,, Brazil	1,439	− 580
,, Austria	1,237	+ 188
Ditto, under 3 kg.	18,490	+ 1,080
To Sweden	1,369	+ 151
,, France	2,729	+ 888
,, Italy	1,025	+ 140
,, Belgo-Lux.	2,217	− 47
,, Netherlands	2,595	− 214
,, Germany	1,196	+ 378
Cables	3,905	− 1,073
Electric locomotives	4,306	+ 4,175
To French Africa	685	+ 659
,, Italy	3,239	+ 3,184

NEW ELECTRICAL EQUIPMENT

Fine-Wire Brazing Machine

Small brazing machines, recently redesigned, form part of the range of machines taken over from British Insulated Callender's Cables, Ltd., by the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester, 16. They are extensively used in the cable making and similar industries for electrically heating the ends of fine copper wires for silver soldering.



Metrovick "BM2M" brazing machine for electrically heating the ends of fine copper wire

The two ends of wire to be soldered are gripped in the clamps at the front of the machine and bent so that the ends spring together. Pressure on the push-button closes the primary circuit and the high secondary current flowing through the joint generates sufficient heat to melt the silver solder, which is applied by hand. The transformer is enclosed in the body of the machine and is normally arranged for connection between phase and neutral of the three-phase supply. A tapping switch is provided to give a range of heating voltages.

Voltage Stabilizer

The quick-response electronic stabilizer made by SERVOMEX CONTROLS, LTD., Crowborough Hill, Jarvis Brook, Sussex, has a voltage range of 1–15 V d.c. and a continuous rating of 0–2·5 A. The voltage drop when the load current is switched on corresponds to an output resistance of 2 MΩ (2·5 A causes a drop not exceeding 5 mV d.c.) while the stability is such that a change in mains voltage of ± 10 per cent causes a change in output no greater than ± 5 mV. The ripple is not more than 3 mV r.m.s. under the worst conditions. Input tappings are provided for 200, 210, 220, 230, 240 and 250 V nominal 50 or 60 c/s. The instrument can also be supplied for 100 to 120 V. The output terminals need not be earthed, and can be operated up to 250 V from earth potential. The impedance between the output circuit and frame is 1 μF shunted by 2·2 MΩ.

Electrical Calculators

Two pocket-sized calculators which will be useful to both students and engineers are offered by BOND CALCULATORS, 118, Gartcraig Road, Glasgow, E.1. One comprises a folding squared chart with kW, kVAr and power factor scales, and two movable celluloid strips calibrated in kVA, which enable the kVA loading at any given kW and power factor to be seen at a glance. The other calculator has on one side load current, h.p. and fuse wire s.w.g. scales which enable any of these three items to be determined, knowing the circuit details. There is also a wire gauge arranged around the periphery of the calculator. The reverse side has a fixed kVA scale and a movable kW scale and an aperture through which power factors can be read for any kW or kVA loading. The prices of these two calculators are 6s 3d and 7s 6d respectively, including postage.

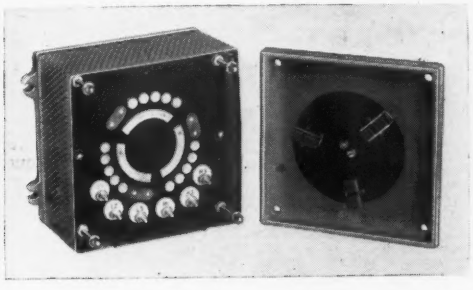
Automatic Cutouts

The WELMEC CORPORATION, LTD., 147, Strand, London, W.C.2, announces the re-introduction on the British market of the AEG "Elfa" cutout. The present cutout is of substantially smaller external dimensions than were previous designs, and approximately equal in size to an Edison cartridge fuse. It is provided with a magnetic instantaneous short-circuit trip and a thermal overload trip of the time delay type. The cutout is supplied as the H-type for general domestic installations, an L-type being designed for close cable protection and other industrial applications

"Elfa" cutouts are supplied for screwing into Edison-type fuse carriers size E27 or for recessed or flush board mounting with front entry and variously arranged terminals. They can be mounted on metering and distribution boards and (with cover plate for the terminals) on walls.

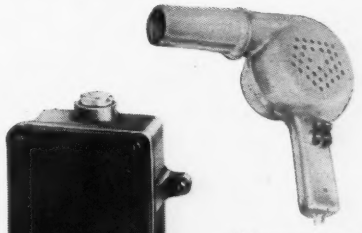
Servomex voltage stabilizer

Kenbar "Elstree" three-phase regulator



Hair Dryer

The hair dryer now being marketed by HILLMAN ELECTRIC MOTORS, LTD., 2–3, Northwold Buildings, Northwold Road, London, N.16, employs a universal motor and is obtainable for voltage ranges from 100/110 to 200/220 and 230/250. The motor, rated at 40 W, is housed in a moulded cream shockproof case and the complete appliance weighs only 1¾ lb. The overall length is 9½in. The slightly longer tapered nozzle is claimed to assist the direction of warm air for quicker and more penetrating drying. The loading of the heating element is 500 W.



Hillman universal hair dryer

Thermovent type WT/45 watertight thermostat

Watertight Thermostat

The range of thermostats manufactured by E. K. COLE, LTD., Southend-on-Sea, Essex, has now been extended by the introduction of a new watertight model (type WT/45) which provides economical operation of electric space heating installations where dampness or rough treatment preclude the use of standard type thermostats.

Particularly suitable for use in greenhouses, it is designed for operation on 250 V a.c. supplies and has a temperature range of 35 to 70 deg F. An accelerator is employed on loads up to 8 A, the maximum load being 15 A.

Finished in matt black, the thermostat zinc alloy case has ¾in screwed spout entry top and bottom, a sealing plug blanking the unused entry. Integral buttressed lugs are provided for easy mounting. Overall dimensions are 6¾in by 4¾in by 2⅞in deep and the retail price is £3 15s.

Three-Phase Regulator

Claimed to be the smallest controller of its kind, the three-phase regulator manufactured by the KENBAR ELECTRICAL CO., LTD., Manor Way, Elstree, Herts, is only 6½in square. Type FR3S is supplied for stator control, has five speeds and off position, and six terminals. The maximum current is 3 A. Type FR3R, designed for rotor control, has six speeds, three terminals and a maximum current of 9 A. The carbon/copper brushes are mounted directly on the cast cover plate, the removal of which isolates the motor supply. Resistances are wound on porcelain formers. A range of three sizes is made, the depth of the case only being affected. The maximum capacity is 360 W.

GENERATION AND DEVELOPMENT

North Wales Water Power

The text of the North Wales Hydro-Electric Power Bill promoted by the British Electricity Authority has been published.

Section 4 of the Bill sets out brief details of 31 "works" which the B.E.A. will carry out in the counties of Merioneth, Cardigan and Montgomery; they include dams and reservoirs at Ffestiniog, on the Afon Ystradau, and on the Afon Rheidol with a number of aqueducts.

A schedule of "Descriptions of Lands for Generating Stations" contains particulars of the sites for the Ffestiniog, Rheidol Upper, Rheidol Intermediate and Rheidol regulating stations.

The Snowdonia Park Advisory Committee has decided to ask the British Electricity Authority to give assurances on a number of points put forward at last week's meeting by Sir Patrick Abercrombie. These related to the proposed pumped-storage hydro-electric scheme at Blaenau Ffestiniog. Sir Patrick considered that as the top dam would be a conspicuous feature its colour was important; the large power house should be designed by a leading architect; and the pipes descending to the lower station should be camouflaged. Sir Patrick was opposed to another transmission line in the Maentwrog Valley.

The Merionethshire planning officer pointed out that the scheme would give employment to about 750 for from five to ten years.

Rise in Output Continues

Both the rate of increase in electricity generated and the amount of plant installed in this country in November were greater than the average for the year. The 183 MW of plant added brought the total installed capacity to over 20,000 MW for the first time and made the net increase since the beginning of the year 846 MW. To equal last year's total of 1,429 MW it would therefore be necessary to install an additional 583 MW of plant during December (in the corresponding month of last year there was a net increase of 512 MW). As will be seen from the accompanying table, the total amount of electricity generated last month (6,984 million kWh) was 14·5 per cent more than in November, 1953, compared with an average increase for the year of 11·1 per cent.

New steam plant installed in B.E.A. power stations last month included 30 MW Metropolitan-Vickers sets at Bold "A" and Roosecote, a 60 MW G.E.C. set at Ince, a 60 MW Richardsons Westgarth set at Portobello, a 515,000 lb/hr International Combustion boiler at Drakelow "A" and a 150,000 lb/hr Simon Carves unit at Blackburn. In addition, six diesel-engine sets, with an aggregate capacity of just over 8 MW, were installed as follows:—Ashford (2 MW, Mirrlees, Bickerton & Day), Clacton (0·95 MW, English Electric), Haverfordwest (1·22 MW, Crossley) and Blackpool (3×1·28 MW, Harland & Wolff).

Torr Achilty Turbine Started Up

The first of the two 7·5 MW turbo-alternators in the North of Scotland Hydro-Electric Board's new power station at Torr Achilty in the Conon Valley, Ross-shire, was started up for the first time on 11th December. Tests and running-in will follow after which the machine will be put on commercial load. The second machine in the power station is in course of erection and will be in production before next summer. The Torr Achilty station is part of the Glascarnoch–Luichart–Torr Achilty scheme, the second stage in the hydro-electric development of the Conon Valley. The Luichart power station (24 MW), also part of this scheme, was brought into production in September. Another two power stations, Glascarnoch (24 MW) and Achanalt (2 MW) are under construction.

Gas–Electricity Choice

A deputation from the South West Scotland Electricity Consultative Council is to ask Glasgow Corporation to give tenants of Council houses the freedom to choose between gas or electricity for cooking. The Council, at a meeting in Glasgow last week, learned that the Corporation is now building more than 5,000 houses a year, and in every case a gas cooker is installed. "We know there are people in the new housing areas who would like to cook by electricity," said Councillor J. D. Kelly, chairman of the Consultative Council. "We therefore feel it our duty to try to get freedom of choice for them."

The question of tenants' choice of service has also arisen in South Wales. At a recent meeting of the Swansea Housing Committee the deputy town clerk said that out of some 306 houses on the Trallwyn estate 130 were being provided with solid fuel cookers and it was intended to install gas cookers and gas boilers in the remainder. The South Wales Electricity Board, to whom an application had been made for a supply for lighting, wished to be able to compete on equal terms with the Gas Board in providing cookers and other appliances. If this were done the Electricity Board would be prepared to lay an underground cable instead of an overhead line to the estate. The Mayor suggested that electrical points should be installed in the houses, giving the two Boards equal opportunities, and this was agreed.

I.O.M. Agreement

Douglas (I.O.M.) Corporation Electricity Committee has approved a plan for the exchange of bulk supplies between the Corporation's Pulrose power station and the Peel station of the Isle of Man Electricity Board for a trial period of a year.

Zanzibar Power Station

The new Saateni power staion has been officially opened by the Sultan of Zanzibar, H.H. Seyyid Sir Klalifa bin Harub, G.C.M.G., C.B.E. The new power station will bring the first a.c. supply to Zanzibar for industrial and domestic use. It is sited a mile and a quarter away from the ancient Arab quarter of Stone Town, and forms an essential part of post-war development in Zanzibar City which aims at creating a modern industrial and community centre at some distance from the crowded harbour area.

The equipment for the station was manufactured by the English Electric Co., Ltd., to the order of the Crown Agents for Overseas Governments and Administrations, and the consulting engineers were Messrs. Preece, Cardew and Rider. The plant comprises three 7-SRL diesel-alternator sets with a continuous output of 1,088 b.h.p. at 375 r.p.m. and generating at 11 kV, 3 phase, 50 c/s. The equipment includes the station accessories, h.v. switchgear, l.v. distribution boards and ten substations for the 11 kV ring main system which makes the supply available at any point on the island. The English Electric Co. has been responsible for the installation of all the equipment including overhead and underground distribution mains.

Barcelona Power Plan

The *Fortnightly Review* of the Bank of London and South America, Ltd., reports that it is proposed to build a large thermal power station at Barcelona to meet the shortage of electricity in the region. The station is expected to be in operation in 1957 and to reach its full output of 1,500 million kWh per annum in the following year. Several small hydro-electric plants are also projected.

Indian Water Power

The extent of present water power development in India and the prospects for expansion are reviewed in a special Central Water and Power Commission number of the *Indian Journal of Power and River Valley Development* (Rs 5). In a foreword, the Minister of Irrigation and Power (Shri Gulzarilal Nanda) says that "after independence, river valley development has become the most prominent feature of the nation's planned effort to conquer poverty and hunger on the land." Numerous signed articles deal with subjects related to water power, including the role of hydrology in project planning, inland navigation, electricity transmission and utilization, the electrification of rural areas, etc.

ELECTRICITY GENERATED AND PLANT INSTALLED*

	Fuel consumed Thousand tons			kWh generated Millions			kWh sent out Millions	Installed capacity (m.c.r.) MW
	Coal	Coke and Breeze	Oil	Steam	Water power	Total†		
British Electricity Authority ...	3,683	96	19·3	6,730	77	6,815	6,415	19,429
N. of Scotland H.E.B.	12	1	1·3	19	145	169	168	586
Total for November, 1954 ...	3,695	97	20·6	6,749	222	6,984	6,583	20,015
Corres. total for November, 1953	3,249	81	10·7	5,900	186	6,099	5,743	18,657
Increase or decrease, per cent ...	+13·7	+19·8	+92·5	+14·4	+19·4	+14·5	+14·6	+7·3
Total to date (11 months), 1954	34,712	1,006	149·9	63,946	1,466	65,541	61,632	
Total for corres. 11 months of 1953	32,060	820	84·0	57,730	1,104	58,979	55,479	
Increase or decrease, per cent ...	+8·3	+22·7	+78·5	+10·8	+32·8	+11·1	+11·1	

* Comprising all generating stations controlled by the British Electricity Authority and the North of Scotland Hydro-Electric Board.

† Including 9 million kWh generated by oil engines and 4 million by waste heat plants in November, 1954.

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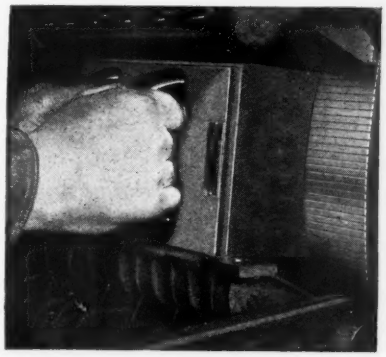

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Floodlights on Parade

This photograph, taken during the recent Northern Command Tattoo in Roundhay Park, Leeds, is a reminder of the important role played by electricity in such spectacular productions.

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Financial Section

STOCKS and SHARES

BY the last week before the Christmas holiday the tone in Stock Exchange markets had become more cheerful than had been the case for a month or so previously. Persistent discussions about dearer money continued to subdue gilt-edged stocks, but their effect upon industrial shares was countered by another instalment of good company dividends and results. Industrials are likely to finish the year below the all-time peaks recorded during its course, but, nevertheless, to retain, according to the price indices, an average appreciation to the tune of nearly 40 per cent over the twelve months. Gains in some of the most popular sections have bordered on the spectacular. Several shares in the "radio" group, for instance, have more than doubled in value since a year ago.

Decca Results

Following the publication of the Decca Record final dividend and another excellent set of results, the 4s ordinary shares were marked up by a further 3s 6d to 53s 6d. They thus approached the end of the year near the top of one of the largest of the many and substantial rises recorded by industrial share prices during the past twelve months. With the group trading profit up by nearly 30 per cent, at £1·7 million, there remains a net surplus of £415,000 after taxation and all charges, from which the dividends on ordinary and preference stocks take less than £200,000 net. It is to be remarked that the final appearance of the excess profits levy in the accounts reduced the surplus by £121,000. The ordinary dividend is being raised to 2s 3d per share, or 6d more than for 1952–53.

New Issues

In addition to the increase in their dividend, Decca stockholders are given notice of proposals (subject to official consent) for a "rights" offer of new ordinary shares at 15s, on a one-for-four basis; for an issue of additional notes; and for a 50 per cent scrip issue. Taking the value of the rights to be in the neighbourhood of 7s 6d per share, the company's 4s ordinary shares thus stand, after their rise, on a prospective yield basis of just about 5 per cent. These latest results refer to the year ended in March, so that three-quarters of the current period is already past. From this standpoint, the company's statement is able to report continued expansion of business since the closing of the accounts.

E.M.I. Earnings

Electric & Musical Industries 10s shares are among those which have doubled their value during the course of this year. They have advanced again, to 24s 6d, since the annual meeting. The chairman made an interesting analysis of the ways in which the group's revenue is disposed. Of the total income of the English company together with its subsidiaries in British territories and the United States, 39·3 per cent was spent on materials and goods; 36·1 per cent on wages and pension provisions; 21·1 per cent on general expenses, depreciation, interest, etc. Of what remained, taxation took 1·6 per cent, and reserves and dividends approximately 1 per cent apiece. In the year under review, the group recovered much of the ground lost in the previous twelve months, and, in paying a 10 per cent dividend, restored half the cut in the 1952–53 dividend from 12 to 8 per cent.

Interim Dividends

Many of the interim dividends declared during the last quarter on account of 1954 have encouraged expectations of a good season when the flow of annual results begins in the early months of next year. As a general market factor, the raising of the I.C.I. interim in September from the equivalent of 3 to 4 per cent has probably had most influence. Other decisions of the same kind, and carrying weight, included those from International Combustion and Babcock & Wilcox. Desoutter Bros. paid a larger interim. Chloride Electrical and Telegraph Condenser are both maintaining last year's interim rates, but on capital doubled by intervening scrip bonuses. Ericssons and London Electric Wire announced increased payments in October. In all these cases the declarations reacted favourably, at the time, on the share prices concerned.

Bonus Implications

In connection with the number of increased interim dividends declared over the past two or three months, it is worth noting that a high proportion of them have come as a sequel to a scrip issue (or capital bonus, to use the old and more familiar term). Most companies deciding to issue new shares free, through a capitalization of reserves, continue to accompany their announcements with the warning that the operation should not be taken necessarily to imply any increase in the amount to be distributed by way of dividend. Experience, however, is cumulatively teaching investors to expect that particular sequence of events. Recent company news has tended to confirm them in such conviction, and it has also encouraged a growing tendency, in general, to value shares more on the basis of the total distributions expected next year, than on the rates paid in respect of 1953.

S. Smith Outlook

Over the past five years the S. Smith & Sons (England) group has invested some £3 million in adding to capital equipment and other fixed assets. The effects of the policy were apparent in the accounts published earlier this month. Group profits before tax expanded by a third, to £2·8 million, enabling the company to raise the ordinary dividend from 15 to 17½ per cent and still to leave the bulk of the surplus to be ploughed back into the business. Mr. Gordon-Smith's speech at the annual meeting shows the intention to continue that process. Further capital expenditure, on hand and projected, is of the order of £1·3 million. This will make large calls on available resources, but it is hoped that they can be financed without need for raising additional capital in the near future. The chairman advises stockholders that, as a result of the policy on selling prices, total group profits may show some reduction during the current year. At 16s the price of the 4s ordinary shares remains at about its highest mark.

Pye Issue

Dealings will have been in progress during the past day or two in the new preference and deferred shares offered by the Pye Company to its existing stockholders. All classes of the latter were invited to apply for a million 5½ per cent preference shares at 21s. Deferred stockholders have the right to take up one new 5s "A" deferred share at 22s 6d for every ten 5s deferred units held. On the basis of the previous quotation of 35s for the latter, the rights at the time of the offer were worth about 1s per share. As notified earlier, the acquisitions for which the new money is required are expected to contribute at least £250,000 to group profits in their first full year's operation.

The Institute of Export

The need for still greater effort in order to maintain and increase our export trade was referred to by Mr. Leslie Gamage, president of the Institute of Export, at the annual dinner of the Institute held on 15th December. Mr. Gamage said that export trade had risen from practically nil in 1942 to 66⅔ per cent over pre-war volume, and while he acknowledged the excellent work of the Board of Trade and overseas ambassadors, commercial secretaries and trade commissioners, he said that the men who had actually done the job were those who sold the goods—members of the Institute. Past achievements did not blind them to the fact that still greater efforts were needed in order to meet increasing competition, coupled with the restrictions on exports in some of our erstwhile best markets. Success would not only depend on the right goods, delivery and price, but also on trained experts in export, and that training could only be had from the Institute.

REPORTS and DIVIDENDS

Heenan & Froude, Ltd.—Mr. C. L. Hill (chairman) presided at the annual meeting held on 16th December. In his circulated statement the chairman, in reviewing the year's activities, said that the most notable achievement in the engine test plant section was the production of a twin high speed dynamometer for a Government Department designed to absorb a maximum of 25,000 b.h.p. over a speed range of 2,500 to 8,000 r.p.m. in the testing of internal combustion engines. Orders for eddy-current couplings increased by 30 per cent on the previous year and in the industrial cooler section business had been good and some large installations of air coolers and water coolers had been completed. Many new contracts were received during the year for refuse disposal and utilization plants and since the close of the year what was believed to be the largest contract in the world for a refuse disposal plant had been awarded to the company by Glasgow Corporation, the value of which exceeded £1,200,000.

Pye, Ltd.—The terms on which the £1,500,000 of new capital (reference to which was made in our 10th December issue) is to be raised have now been announced. Stockholders of all classes will be able to apply for 1,000,000 5½ per cent £1 shares at a price of 21s each. Deferred ordinary and "A" deferred ordinary stockholders will have the right to 456,917 5s "A" deferred ordinary shares at a price of 22s 6d each in the proportion of one new share for every ten 5s stock units held. Consent of the Capital Issues Committee has been obtained and both issues are being underwritten by W. Greenwell & Co. Resolutions to increase the capital were passed at an extraordinary meeting held on 17th December.

Joseph Lucas (Industries), Ltd.—Presiding at the annual meeting held on 13th December, Mr. A. B. Waring (chairman) said that the increase in the consolidated surplus for the year under review was the result of the greatly increased activity during the year in all the industries which the group served. The motor industry was working to full capacity and programmes were in hand for increased production. The company had kept pace with current demands and was in course of implementing plans for still further increasing its capacity to meet future requirements. For the aircraft industry, equipment sales showed a further increase. The research, design and development activities in the service of these two industries had been expanded and intensified during the year, and the design of lighting, starting and ignition equipment and other equipment was continuously under review.

Aerialite, Ltd.—The annual meeting was held on 16th December, Mr. L. S. Hargreaves (chairman and managing director) presiding. In his circulated statement, the chairman said that in spite of keen competition in certain types of cable due to the uncertainty caused by the Monopolies Commission's Report, the balance sheet for the year under review was very satisfactory. The order book was healthy and they were doing increasing business with the Electricity Boards, the building trade, radio and television manufacturers, and the motor trade. Steps were being taken, by re-equipment of their plant, to become more competitive. The demand for their products was very strong and they had been unable to execute a large volume of business due to sales exceeding productive capacity, and this would mean in the not too distant future some extension of their activities. Their Nettle business had improved considerably and the profits were steadily rising due to the development of a number of products which were in strong demand.

Oriental Telephone & Electric Co., Ltd.—For some time negotiations have been proceeding between the Governments of Singapore and of the Federation of Malaya and the Oriental Telephone & Electric Co., Ltd., concerning the detailed arrangements for the handing over of the company's telephone undertakings in Singapore and Johore Bahru respectively on 1st January next. Inventory agreements have already been signed and purchase agreements are now being completed. It has been agreed that the purchase agreements shall provide for payments on account of the purchase price to be made to the company on 31st December of 14,500,000 Malayan dollars by the Singapore Government and of 500,000 Malayan dollars by the Government of the Federation of Malaya. It has further been agreed that if during the course of the valuation of the company's undertakings it appears that the final purchase prices to be paid will differ substantially from these amounts paid on account, consideration will be given by the two Governments to the payment of further sums on account to the company, or by the company to the repayment of part of such payments received to the two Governments, whichever is applicable. Further, the two Governments and the company have agreed that interest at the rate of 4·2 per cent per annum shall be paid by the two Governments or by the company, as the case may be, on the differences outstanding from time to time between the payments made on account and the purchase prices as finally determined, calculated from 1st January, until such balances are paid.

S. Smith & Sons (England), Ltd.—In the course of his speech at the annual meeting held on 14th December, Mr. R. Gordon-Smith (chairman and managing director) said that the progress in the clock and watch division had been satisfactory and sales had increased progressively throughout the year. The industrial instrument division also showed steady progress and increasing turnover. The sales of Kelvin & Hughes exceeded substantially those of the previous year and again established a record. Their activities in the electronic field were expanding rapidly.

Marco Refrigerators, Ltd., reports a group profit for the year to 30th September last of £4,470, as compared with £316 for the preceding year. Taxation requires £3,085 and it is proposed to pay a final dividend of 2½ per cent, making 5 per cent for the year (against nil). The balance carried forward is £40,839 (against £45,452 brought in).

Telephone Rentals, Ltd., has declared an interim dividend of 4 per cent (same) on larger capital.

Vactric, Ltd., is applying to the Capital Issues Committee for permission to make scrip issues of one new ordinary share for each ordinary share held and one new 6 per cent £1 preference share for each four ordinary shares held.

New Companies

Thornton and District Electric Co., Ltd.—Registered 26th November. Capital £3,000. To acquire the business of radio and electrical engineers heretofore carried on by L. S. Wetherley and J. R. Reid, at 13, Longton Avenue, Thornton-le-Fylde, Lancs. Directors: L. S. Wetherley and J. R. Reid. Regd. office: 62, Fleetwood Road, Thornton-le-Fylde.

G. J. Wade & Son, Ltd.—Registered 27th November. Capital £10,000. Electrical contractors, wholesalers, distributors and importers of and dealers in electrical goods, radio and television sets, etc. Directors: W. J. Wade, Mary J. Wade, J. C. Knight and Gwendoline M. Knight. Regd. office: 28a, Widmore Road, Bromley, Kent.

Spencer & Hill, Ltd.—Registered 1st December. Capital £1,000. Electrical and electronic engineers and contractors, etc. Directors: W. A. Spencer, and F. B. Hill. Regd. office: 34, North Street, Bingley, Yorks.

A. Parsons (Electrical Fittings), Ltd.—Registered 8th December. Capital £500. Directors: A. Parsons and Mrs. Christine E. Parsons. Secretary: Christine E. Parsons. Regd. office: 5 & 6b, Wellington Street, Brighton.

L. A. Stockwell & Sons, Ltd.—Registered 8th December. Capital £1,000. Manufacturers, distributors, agents and wholesale and retail dealers in electrical goods, wireless and television sets, etc. Directors: L. A. Stockwell and Muriel D. Stockwell. Secretary: Chas. D. Blake. Regd. office: 11, Manor Corner, Manor Road, Paignton.

I.S.T. Insulations, Ltd.—Registered 7th December. Capital £100. To acquire and hold shares, stocks, debentures, etc., and to carry on business as manufacturers and dealers in all kinds of electrical insulating materials, electrical instruments, tools, radio and telephone apparatus and supplies, etc. Directors: J. N. Bullivant, director of Sterling Varnish Co., Ltd., etc., K. R. Wilcox and E. L. Hoyle. Secretary: Joseph Baron. Regd. office: Electron Works, Brook Street, Preston.

N.E. Electric & General Supplies, Ltd.—Registered 1st November. Capital £10,000. Electrical factors, electricians, etc. Directors: Margaret R. Lawson, H. B. C. Sanderson, and Margaret E. Wellard. Solicitors: Wheldon & Co., South Shields.

Bankruptcies

D. A. Trotman, formerly carrying on business as an electrical engineer at Salter Street, Berkeley, Glos.—Receiving order made 8th December on a creditor's petition. Public examination 23rd February at the Shire Hall, Gloucester.

C. T. Boden, carrying on business as a wholesale electrical hardware and fancy goods dealer under the style of the High Peak Wholesale Electrical Supplies at 5, Hartington Street, Derby, and as a retail electrical, hardware and fancy goods dealer, at "Anafon," Abergele Road, Old Colwyn, Flint.—Public examination, 15th March at the Court House, 20, St. Peter's Church Yard, Derby.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 26th January from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1950

12654. Soc. Anon. des Cableries & Trefileries.—Moisture resistant sheath for electric cables. 19th May, 1950. (722312.)

29621. British Thomson-Houston Co., Ltd. —Wave-guide switching arrangements. 20th November, 1951. (722406.)

31184. Advance Transformer Co.—Apparatus for starting and operating gaseous discharge devices. 21st December, 1950. (722315.)

31506. Conradty, E. (trading as Conradty, C.).—Carbon or graphite electrodes. 28th December, 1950. (722506.)

1951

10456. Reyrolle & Co., Ltd., A.—Arc-chutes for air-break electric circuit breakers. 28th April, 1952. (722604.)

13850. Compagnie des Machines Bull.—Electrical calculating apparatus. 11th June, 1951. (722509.)

14525. Clang, Ltd., and Harwood, C. D.—Electric switches of the ceiling or pull-operated type. 18th June, 1952. (722416.)

14652. General Electric Co., Ltd., and Donelan, J. A.—Methods of and apparatus for gas shielded electric arc welding. 20th June, 1952. (722707.)

14656. Metropolitan-Vickers Electrical Co., Ltd.—Insulation of the windings of dynamo-electric machines. 8th July, 1952. Cognate application 25252, 29th October, 1951. (722417.)

20115. Lucas (Industries), Ltd., J., formerly Lucas, Ltd., J.—Windings for dynamo-electric machines. 15th August, 1952. (722420.)

20865. Metropolitan-Vickers Electrical Co., Ltd.—Electrical apparatus for controlling equipment in dependence on the displacement of a part thereof. 27th May, 1952. (722421.)

20991. Beer, E., and Beer, H. B.—Process and apparatus for renewing exhausted primary, more particularly dry, electric cells or batteries. 5th September, 1951. (722323.)

24782. Staatsbedrijf der Posterijen Telegrafie en Telefonie.—Arrangement for the conversion of voltages of analogue form into binary codes and vice versa. 23rd October, 1951. (722519.)

25495. Siemens-Schuckertwerke Akt.-Ges. —Process for the production of selenium rectifiers. 31st October, 1951. (722426.)

26308. Electric Construction Co., Ltd.—Electrical driving equipment for textile winding machines. 7th November, 1952. (722712.)

27942. British Telecommunications Research, Ltd.—Electrical switching arrangements suitable for use in signalling systems. 20th November, 1952. (722714.)

28899. Metropolitan-Vickers Electrical Co., Ltd.—Thermionic valve amplifying circuit arrangements. 10th December, 1952. (722428.)

29111. Philips Electrical Industries, Ltd.—Protective circuits for X-ray tubes. 12th December, 1951. (722330.)

29518. Jennings Musical Instruments, Ltd., and Hills, L. J.—Electrical oscillation generator. 16th December, 1952. Cognate application 11826, 9th May, 1952. (722430.)

1952

256. British Thomson-Houston Co., Ltd.—Measuring instruments. 27th October, 1952. (722718.)

292. General Electric Co., Ltd., and Hunt, G. J.—Wattmeters for use at radio frequencies. 5th January, 1953. (722530.)

711. British Thomson-Houston Co., Ltd.—Light modifying mediums. 20th November, 1952. (722719.)

4730. Standard Telephones & Cables, Ltd. —Cross-bar switches of the type used in telephone systems. 22nd February, 1952. (722435.) 6638.—Cross-bar multi-switches. 14th March, 1952. (722438.)

6681. General Electric Co., Ltd., and Harkus, G. N.—Automatic electric switches and closing arrangements therefor. 12th March, 1953. (722731.)

6913. Jackson, E. W.—Mounting of electrical switches or other units in wall boxes. 17th March, 1953. (722613.)

8840. Leyhausen, W.—Automatic electric switches having overload release means. 7th April, 1952. Addition to 721300. (722615.)

8957. General Electric Co., Ltd.—Electron gun assemblies for electric-discharge devices. 8th April, 1953. (722345.)

9071. English Electric Co., Ltd.—Resilient torque transmitting couplings. 27th March, 1953. (722734.)

9334. Ferranti, Ltd.—Radio navigation systems. 14th July, 1953. (722545.)

10789. Southern United Telephone Cables, Ltd.—Tool for the extraction of insulating discs from the end of a length of coaxial electric communication cable. 29th April, 1953. (722547.)

13299. General Electric Co., Ltd., Forbes, W. A., and Burbidge, T. W.—Apparatus for periodically interrupting one or more electric signals. 10th March, 1953. (722550.)

15617. English Electric Co., Ltd.—Electric motor control systems. 19th June, 1953. (722744.)

16298/9. Siemens Bros. & Co., Ltd.—Automatic gain controlling arrangements for telecommunication systems. 26th June, 1953. (722360/1.)

16318. Siemens & Halske Akt.-Ges.—Electric condensers. 27th June, 1952. (722747.)

18279. Westinghouse Electric International Co.—Electronic indicator circuits. 18th July, 1952. (722557.)

19658. Bial, W.—Electric transmission systems. 4th August, 1953. (722559.)

20374. Micafil, Ltd.—High voltage electrical transformers. 13th August, 1952. (722560.)

20460. Philips Electrical Industries, Ltd.—Glow-discharge tubes. 14th August, 1952. (722465.)

21652. Standard Telephones & Cables, Ltd. —Signal compression and expansion arrangements for electric communication circuits. 21st August 1953. (722371.)

21669. General Electric Co., Ltd., and Collins, L.—Arrangements of the kind including thermionic valves for generating electric oscillations. 28th August, 1953. (722469.)

21979. Metropolitan-Vickers Electrical Co., Ltd.—Dynamo-electric machines. 31st August, 1953. (722470.)

22563. Siemens & Halske, Akt.-Ges.—Storage devices for transmitting series of electrical impulses. 8th September, 1952. (722761.)

22940. Siemens Bros. & Co., Ltd.—Electric apparatus, such as magnetic amplifiers, employing saturable regulating chokes. 11th September, 1953. (722565.)

23101. Leece-Neville Co.—Battery circuit embodying a series-parallel switch device. 15th September 1952. (722372.)

23971. Philips Electrical Industries, Ltd.—Soldering apparatus. 24th September, 1952. (722480.)

24530. Bosch Ges., R.—Electric condensers. 1st October, 1952. (722635.) 24792. —Electric condensers embodying metallized strips of dielectric material. 3rd October, 1952. (722636.)

26200. British Telecommunications Research, Ltd.—Television systems. 9th October, 1953. (722769.)

27328. Standard Coil Products Co., Inc.—Inductor units. 30th October, 1952. (722389.)

27440. Standard Telephones & Cables, Ltd. Multiple outlet field for a multi-switch of the crossbar type. 31st October, 1952. (722487.)

28762. Standard Telephones & Cables, Ltd. —Manufacture of electrical capacitors. 14th November, 1952. (722488.)

29667. Automatic Electric Laboratories, Inc.—Automatic telegraph switching systems. 24th November, 1952. (722777.)

31304. Aluminium Francais. — Electrical connectors. 10th December 1952. (722584.)

32464. Fox, B.—Multi-contact electric plug-and-socket connectors. 22nd December, 1952. (722644.)

1953

868. General Electric Co.—Refrigerating systems. 12th January, 1953. (722652.) 869. Two-temperature refrigerating systems. 12th January, 1953. (722653.) 870. Refrigerating apparatus. 12th January, 1953. (722654.)

1265. Clausen, M. (trading as Danfoss). —Electric snap-action switches. 15th January, 1953. (722658.)

1338. Standard Telephones & Cables, Ltd. —Directional couplers for microwave transmission systems. 16th January, 1953. Addition to 704050. (722660.)

1565. Telefunken Ges. für Drahtlose Telegraphie.—Very high frequency valve and wave guide installation. 19th January, 1953. Addition to 714827. (722663.)

2615. Sangamo Weston, Ltd.—Movable coil electrical instruments. 29th January, 1953. (722668.)

2806. Soc. Anon. de Télécommunications. —Manufacture of tubular insulators for electric conductors. 30th January, 1953. (722591.)

2994. Westinghouse Electric International Co.—Dynamic braking control systems for electric driving motors. 3rd February, 1953. (722671.) 2996.—Dynamic braking control systems for electric driving motors. 3rd February, 1953. (722672.)

3888. Dow Corning, Ltd.—Organopolysiloxane electrical insulating material. 11th February, 1953. (722593.)

8404. Kruger, P. E. F.—Coupling for electric cables. 26th March, 1953. (722682.)

8934. Standard Coil Products Co., Inc.—Tuning units for television receivers. 31st March, 1953. (722787.) 11253.—Power amplifier. 23rd April, 1953. (722684.)

15610. Siemens & Halske Akt.-Ges.—Method of measuring low pressures with an ionization gauge comprising a cold cathode. 5th June, 1953. (722788.)

16554. Western Electric Co., Inc.—Electrolytic capacitors. 16th June, 1953. (722789.)

18107. Philips Electrical Industries, Ltd.—Circuit arrangements, each comprising a magnetron to be excited by pulses. 30th June, 1953. (722694.)

27327. Fillery, G. T.—Combined suction cleaner and floor polisher. 29th February, 1952. Divided out of 722602. (722700.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—1st February. Electricity Commission of New South Wales, Sydney. 132 kV transmission line, Waratah to Taree (Karuah Taree section). (E.S.B. 29084/54. Ten/11839.)* 7th February. Four 45 MVA 132 kV transformers for Bunnerong power station. (E.S.B. 29087/54. Ten/11842.)*

11th February. Brisbane City Council. Twelve 33 kV outdoor type oil circuit breakers. (E.S.B. 28804/54. Ten/11795.)*

Bath.—13th January. Spa Committee. Electrical installation at the Pump Room. (See this issue.)

Brazil.—5th April. Comissao Estadual de Energia Eletrica, Porto Alegre. Cables, insulators, steel pylons, etc., for the 138 kV transmission lines of the Jacui hydro-electric power station, Rio Grande do Sul. (E.S.B. 28818/54. Ten/11791.)*

Carlisle.—17th January. City Council. Street lighting equipment. (See this issue.)

Egypt.—12th January. Cairo Electricity and Gas Administration, Ministry of Public Works. Underground and submarine h.v. cables. (E.S.B. 29119/54. Ten/11840.)*

Formosa.—18th January. Taiwan Power Co. Switchboard equipment for 154 kV transmission lines and existing panels. (E.S.B. 28855/54. Ten/11828.)*

India.—4th January. Government Electricity Department, Madras. 33 kV and 11 kV cables and cable boxes. (E.S.B. 28761/54. Ten/11799.)* 22nd February. 110 kV and 66 kV transmission lines. (E.S.B. 28762/54. Ten/11815.)*

Iraq.—1st January. Directorate General of Municipalities, Bagdad. Two 50 kW diesel electric generating sets. (E.S.B. 28737/54. Ten/11790.)* 31st January. One 100 kW diesel electric generating set. (E.S.B. 28758/54. Ten/11781.)* One 100 kW diesel generating set. (E.S.B. 28759/54. Ten/11782.)* One 100 kW diesel set. (E.S.B. 28739/54. Ten/11780.)* Two 100 kW and one 50 kW diesel sets. (E.S.B. 28738/54. Ten/11800.)*

Kuwait.—9th January. Electricity Department. Electric cable. (E.S.B. 28749/54. Ten/11802.)*

New Zealand.—27th January. New Zealand Post Office, Wellington. Telephone cable. (E.S.B. 28921/54. Ten/11811.)* Condensers. (E.S.B. 28922/54. Ten/11810.)*

Sa'isbury.—2nd February. Wilts County Council. Electrical installation at St. Thomas's Secondary School. (See this issue.)

Scunthorpe.—12th January. Corporation. Street lighting equipment. (See this issue.)

South Africa.—6th January. Union Tender and Supplies Board, Pretoria. Radio parts and valves. (E.S.B. 28834/54. Ten/11797.)*

12th January. Stores Department, South African Railways, Johannesburg. Lightning arrestors. (E.S.B. 29007/54. Ten/11820.)*

21st January. Durban Corporation. Low voltage fuses. (E.S.B. 28659/54. Ten/11793.)*

Southern Rhodesia.—7th January. Ministry of Posts, Salisbury. Private automatic branch telephone exchange. (E.S.B. 28992/54. Ten/11826.)*

United States.—20th January. Corps of Engineers, Portland, Oregon. Conductor cables for the Dallas Dam. (E.S.B. 28584/54. Ten/11814.)* 1st February. Main unit switchgear units for the Dallas Dam power house. (E.S.B. 28863/54. Ten/11827.)*

11th January. Bureau of Reclamation, Denver, Colorado. Carrier current supervisory control and telemetering equipment for Watertown and Oahe temporary substations. (E.S.B. 28859/54. Ten/11825.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

ORDERS PLACED

Hale (Ches.)—U.D.C. Group "A" road lighting installation on Hale Road and Group "B" road lighting on Victoria road.—Cohen Bros. (Electrical).

Hartlepool.—Town Council. Electrical rewiring of Hartlepool Borough Buildings (£1,149).—John Westmorland & Co.

Haverfordwest.—Corporation. Accepted. Electric lighting, Prospect Place estate, Lower Prospect Place, Winch Lane, Bush Row and Winch Crescent (£1,488).—South Wales Electricity Board.

Peterborough.—City Council. Accepted. Electrical installations in 70 houses on the Walton estate (£1,538).—Peterborough General Electric Co. Ditto in 68 houses (£1,486).—M. F. Hansen.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Abergele.—Extensions to Llys Onnen Home for the Blind; Charity, Thirtle & Duke, architects, 14, Howick Place, Victoria Street, London, S.W.1.

Billingham-on-Tees.—Large additions to the plant for the manufacture of higher alcohols; Imperial Chemical Industries, Ltd.

Birmingham.—County primary school at Sutton Road, Erdington, and two schools at Shenley Hill; E. L. Russell, chief education officer.

Blackpool.—Houses (67), Salmesbury Avenue, Salcombe Avenue and Runcorn Avenue; R. Fielding & Sons (Builders), Ltd., Stanhope Road Works.

Boston.—First section of scheme for new county offices in London Road (£47,000) for Holland C.C.; county architect, County Hall, Boston.

Bristol.—Shops and offices, with cinema, Wine Street and Fairfax Street; Jacey Investments, Ltd., Somerset House, Temple Street, Birmingham.

Chesterfield.—Church Hall and Sunday School for Congregational Church (£27,000); G. F. Kirk, Ltd., Chesterfield.

Coventry.—Flats (1,037) and houses (631), Bell Green; Geo. Wimpey & Co., Ltd., Hammersmith, London, W.6.

Crawley.—Fire station; James Longley & Co., Ltd., builders, Westfield Works.

Crayford (Kent).—Houses (102), Normandy Farm; U.D.C. surveyor, Town Hall.

Croydon.—Secondary technical school, off Pampisford Road; C. T. Ayerst, architect, 38, High Street.

Ealing.—Houses (154), Lime Trees estate; T. F. Nash, Ltd., builders, Uxbridge Road, Hayes, Middx.

Enfield.—First stage of new municipal offices; U.D.C. surveyor.

Huddersfield.—Fire station, Manchester Street area (£100,000); borough architect, High Street Buildings.

Huyton-with-Roby.—Day special school (£41,487) for Lancs E.C.; county architect, Fishergate Hill, Preston.

Leeds.—School clinic and maternity and child welfare centre on site at Seacroft; city architect, Priestley House, Quarry Hill, 9.

Leicester.—Erection of Overdale Junior School (£78,485); city architect.

Lewes.—Houses (148), Montford estate; borough engineer.

London.—Six-storey office block, 11/12, Coopers Row; L. W. Hammerson & Partners, Ltd., Quadrex House, Park Lane, W.1.

School, Brightfield Road and Taunton Road, Lee; Covell & Matthews, architects, 48, Seymour Street, W.1.

Reinstatement of Church of St. Clement Dane; W. A. S. Lloyd, architect, 5, Pickering Place, S.W.1.

Loughborough.—Covered market; borough surveyor.

Maidstone.—Extensions to council offices and building department (£49,950); county architect, Springfield, Maidstone.

Manchester.—Dwellings (72), Sandy Lane, Pendleton, for Trustees of Booths Charities; Moston Brick & Building Co., Ltd., Kenyon Lane, Collyhurst, Manchester.

Middlesbrough.—First instalment of Cleveland Technical College (£137,650); county architect, Northallerton.

Morpeth.—Houses (650), during the next five years for the R.D.C.; J. R. Miles, surveyor, Dacre Street.

Newcastle-on-Tyne.—Factory, Station Road, for M. Sutherland & Co., Ltd.; C. Solomon, architect, 30, St. Mary's Place.

Five-storey flats, Scotswood Road; city architect, 18, Cloth Market, Newcastle.

Northumberland.—Fire station, Bellingham; county architect, County Hall, Newcastle-on-Tyne.

Ockendon.—Boys' secondary school (£128,000); Howard V. Lobb & Partners, architects, 20, Gower Street, London, W.C.1.

Oldbury.—Houses (175), Cakemore estate; borough surveyor, Municipal Bank Chambers.

Otley.—Extensions to Albert Works, North Street, for Wm. Sinclair & Sons, Ltd.; Oswald Holmes & Son, architects, Otley.

Penarth (Glam).—Residential school for handicapped children; county architect, Glamorgan County Hall, Cardiff.

Peterborough.—Houses (30), Croyland Road; Rutland Estates, Ltd., Eastgate, Peterborough.

Dwellings (140), Welland Road; city architect, Bridge Street.

Peterlee.—Twenty-two shops for Peterlee Development Corporation, Shotton Hall, Castle Eden; W. J. Scott, chief architect.

Plymouth.—Flats (124) and shops (13), Western Approach; city architect.

Ramsgate.—Showrooms and offices, Queen Street and Harbour Street; Montague Burton, Ltd., Hudsons Road Mills, Leeds, 9.

Rayleigh.—Sweyne County Secondary School (£233,230); H. Conolly, county architect, County Hall, Chelmsford.

Rochester.—Electrical installations in 36 flats in Corporation Street; W. Law, city engineer, 66, Maidstone Road.

Rugby.—Memorial hall, council chamber, offices, etc. (£170,500); borough surveyor, Burford House, Church Walk.

Seaham.—Houses (150), to be erected in 1955; U.D.C. surveyor.

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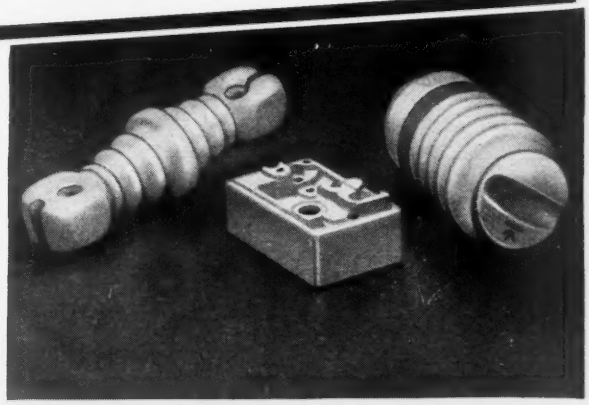

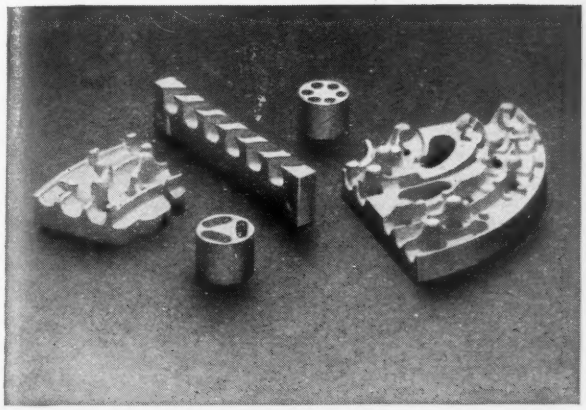

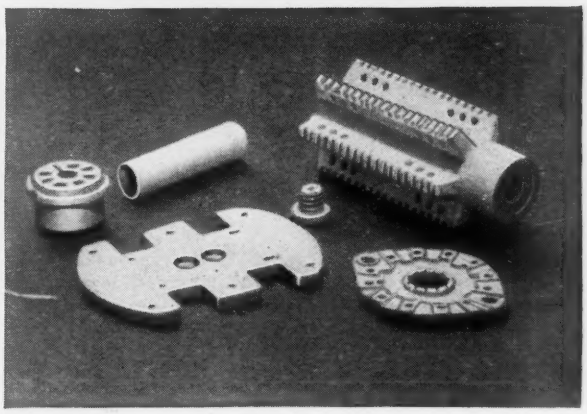

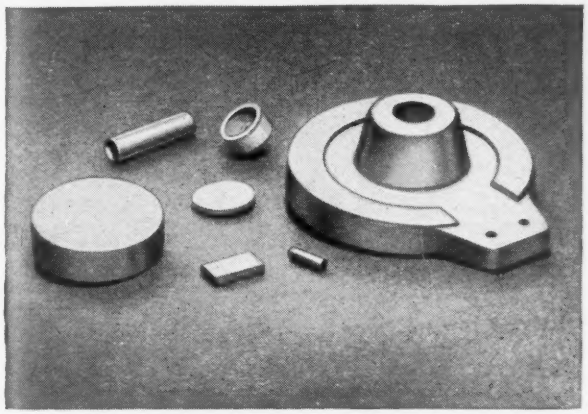

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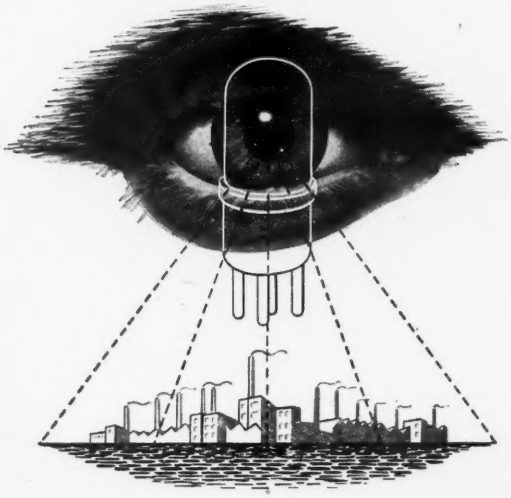

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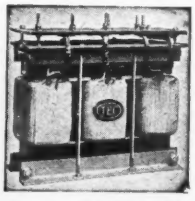

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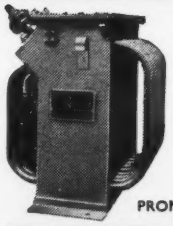

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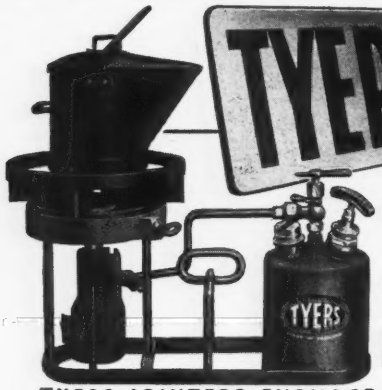

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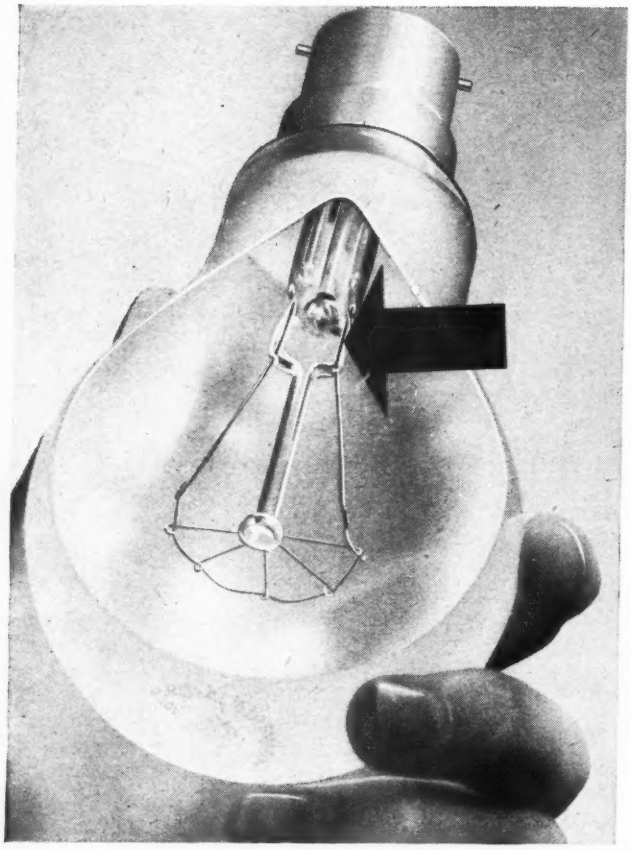

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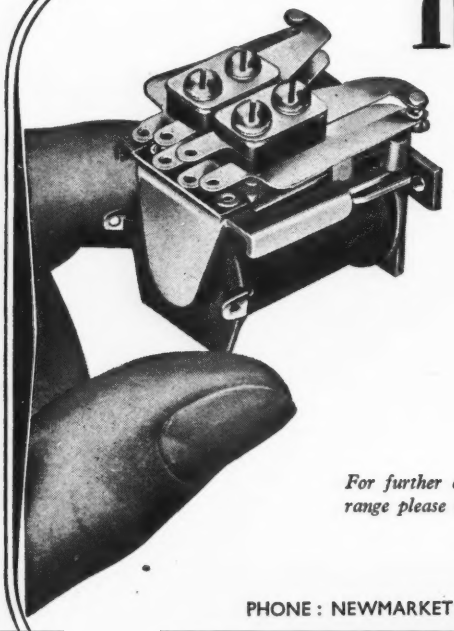
Manufacturers of Simmerstat, Oven Thermostats, Radiant Hotplates and Pneumatic and Electrical Instruments for detection, measurement, control and recording of Temperature, Flow, Liquid Level, Specific Gravity and Pressure, in Science and Industry. Vacuum Pumping and Measuring Equipment, etc.

Member of the A.E.I. Group of Companies.

TAS/Sc. D.282

RELAYS



A compact design for close stacking

SERIES 595 D.C. OPERATED

This extremely compact relay has its connections to both contacts and coil brought conveniently to one end, and is designed without projections to facilitate close stacking where banks of Relays are in use. The contact current handling capacity is exceptionally high in relation to the overall dimensions of the Relay. Good armature design has reduced the effects of shock, vibration and acceleration, and the spring type hinge eliminates backlash friction and risk of displacement.

For further details of our range please write.

PHONE : NEWMARKET 3181-2-3 TELEGRAMS : MAGNETIC NEWMARKET

MAGNETIC DEVICES LTD
NEWMARKET

MD IC

The wide diversities of engineering find ever-growing scope in

TRANSOPRINT PRINTED SELF-ADHESIVE TAPE

FOR INSTRUCTING, CODING, BRANDING

NAMING, SEALING AND SECURING

Gosheron

Every business can profit by using quick, clean, attractive Transoprint. Send for specimens and see how usefully you can apply this modern medium to your own problem and purpose.

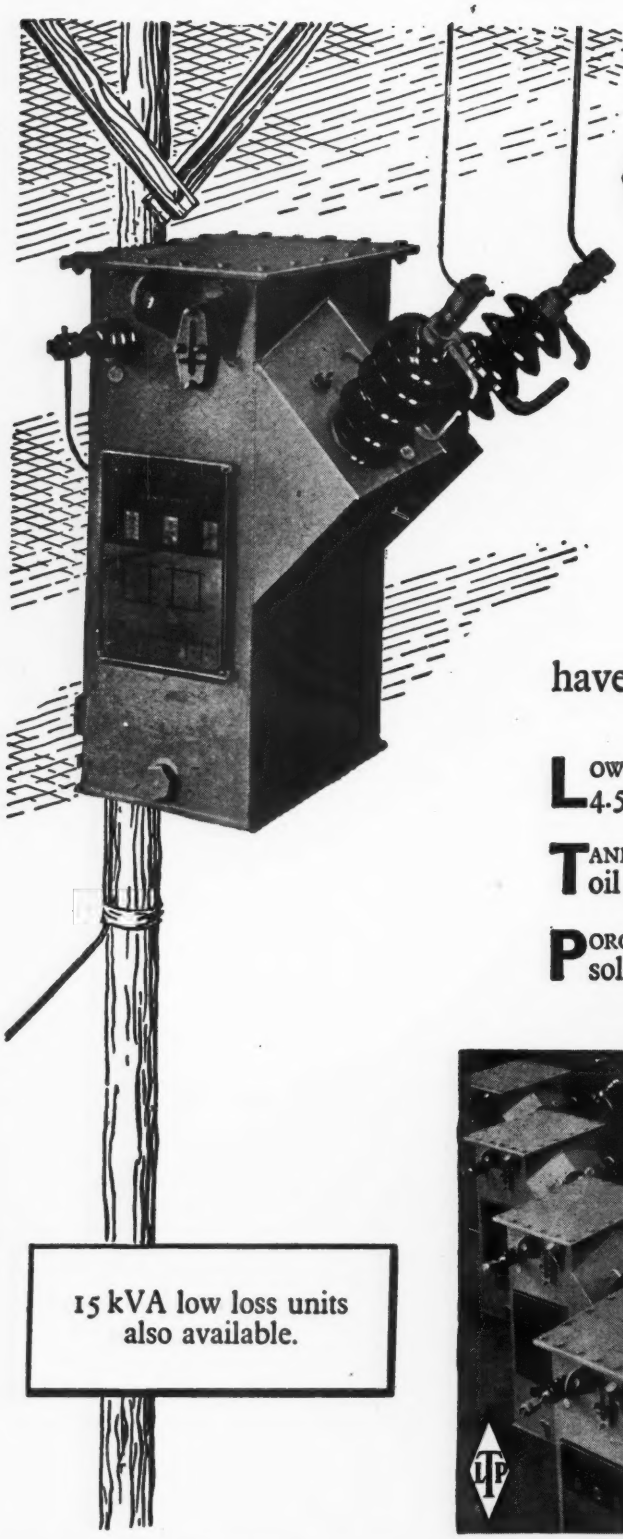
JOHN GOSHERON & CO LTD GAYFORD ROAD LONDON W12
Telephones: SHEpherds Bush 3326-8 & 6271-4 (7 lines)

LIGHTING

In public halls and civic assembly rooms the need for emergency lighting is now accepted. In future buildings of this sort the stand by electrical system will be planned at the same time as the main lighting is planned. Chloride Batteries Ltd. makers of Keepalite, the automatic emergency lighting system, offer the advisory services of their engineers to architects and electrical contractors in any part of Britain.

Keepalite
FOR PUBLIC HALLS

A Product of Chloride Batteries Limited, Exide Works, Clifton Junction, Swinton, Manchester and Grosvenor Gardens House, Grosvenor Gardens, SW1 S.73A



Transformers for Rural Distribution

have the following advantages –

LOW LOSSES and high overload capacities; 4.5 kVA normal rating; ratio 11,000/250V.

TANKS have single bolt fixing, domed cover, oil gauge and thermometer pocket.

PORCELAIN BUSHINGS easily replaced on site; solderless connectors and H.V. arcing horns.

15 kVA low loss units also available.

LONDON TRANSFORMER PRODUCTS LTD.

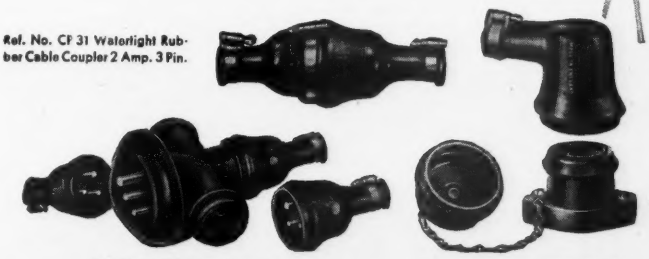
Head Office: *Telephone: Willesden 6486*
COBBOLD ESTATE, LONDON, N.W.10.

Main Works: *Telephone: Bridgend 901*
GATE ROAD, TRADING ESTATE, BRIDGEND, GLAMORGAN.

SETTLE for NETTLE

The new NETTLE range of Weatherproof Rubber-clad Couplers, Sockets and Plugs is fully described in a new leaflet now available. A few typical items from this range are shown below. Write to-day for full details.

Ref. No. CF 31 Watertight Rubber Cable Coupler 2 Amp. 3 Pin.



Ref. No. A133 Weatherproof 3-way Rubber Socket Adaptor 5 Amp. and 2 Amp.

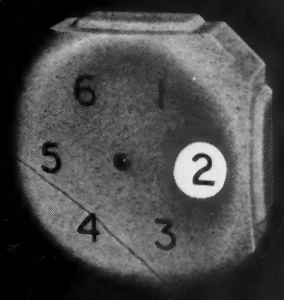
Ref. No. P32 and SP32 Weatherproof Batten Socket and Plug Top Side Entry, 2 Amp. 3 Pin.

*Also available, the comprehensive Nettle Catalogue containing details of the full range of **NETTLE** Shockproof Electrical Accessories. You are invited to write for a copy.

NETTLE ACCESSORIES LTD.
HARPER ROAD · WYTHENSHAWE · MANCHESTER

MEMBER OF THE AERIALITE GROUP

QUICK STAFF LOCATION



The Sterdy 6-way Clock Location Indicator System will help you locate your staff quickly and efficiently, thus saving valuable time.

An audible call to attract attention is given when the signals (which may be steady or flashing) are illuminated.

This simple installation has been widely adopted by factories, offices, Government departments and institutions.

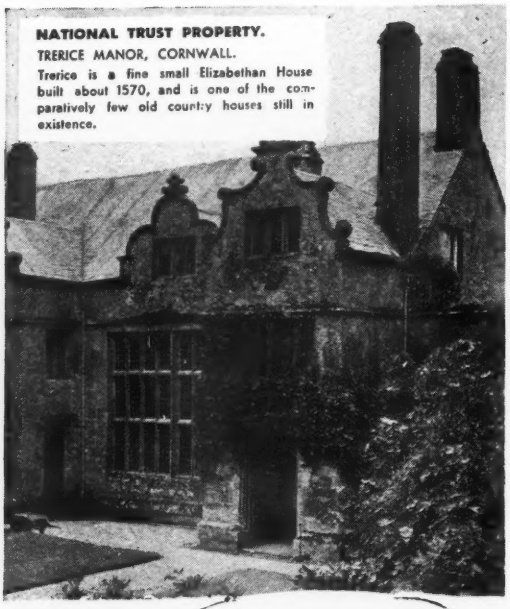
W. C. DAVEY & CO.
Queens House
180-182a, Tottenham Court Rd., London, W.1
Telephone: MUSeum 4414, 4415 & 6388

EST. STERDY 1920 TRADE MARK

Copper CLAMPING WASHERS

ALL SIZES
We specialise in all forms of well-finished pressings.
Your enquiries invited

The HAMPTON WORKS (STAMPINGS) LIMITED
PRESSWORK EXPERTS
TWYNING ROAD · STIRCHLEY · BIRMINGHAM · ENGLAND
Tel: KINgs Norton 2901 (3 lines) 'Grams: Radiagills, B'ham.


NATIONAL TRUST PROPERTY.
TRERICE MANOR, CORNWALL.
Trerice is a fine small Elizabethan House built about 1570, and is one of the comparatively few old country houses still in existence.

Protected

CONDENSER COATING
CABLE IMPREGNATING
V.I.R. CABLE FINISHING
CHOKE FILLING

WE ARE EXHIBITING AT THE
Packaging Exhibition
By Provincial Exhibitions Ltd.
18-28 Jan. '55
National & Empire Halls
OLYMPIA
London

STAND No. 4

WHITEHEAD
PROTECTIVE WAXES

The name to watch in waxes

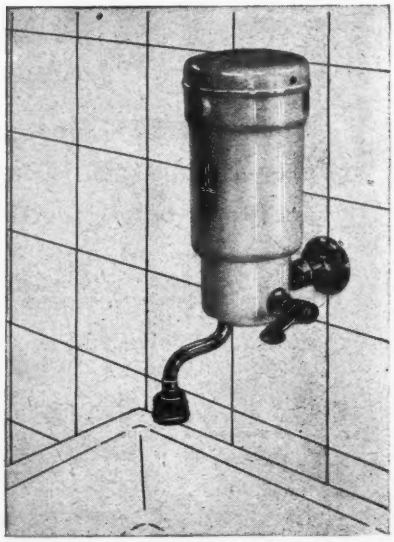
WHITEHEAD CHEMICAL CO. (WAXES) LIMITED
MIDLAND BANK CHAMBERS, 77 KING STREET, MANCHESTER 2.
Telephone and Telegrams: BLAckfriars 8503
Works:—Holt Mill Road, Waterfoot, Lancs. 'Phone Rossendale 1751.

Agent for Scotland:—
GEORGE R. ALVEY, 19 Walker St., Edinburgh 3. Tel.: Edinburgh 31127.

INSTANTANEOUS HOT WATER GEYSER

—

NO FLOW OF WATER NO ELECTRICITY USED



Turn on the water tap and obtain immediately a steady flow of hot water. Output approx. 4 pints per min. at 95° F., 2 pints per minute at 120° F. Cannot burn out due to lack of water. Reduce electricity bills. Easily fitted.

The ideal heater for any wash basin or toilet in the Home, Office, Factory, etc.

ELTRON (LONDON) LTD.
STRATHMORE ROAD, CROYDON
Telephone: Thornton Heath 1861

FOR ANYTHING IN **MICA** — Natural in all Grades and Qualities, Stove Micas, Plates, Washers, Commutator Segments, Condenser Films, etc.

MICANITE — Moulding, Commutator Flexible, Heat-resisting Qualities, Commutator Rings, Spools, Tubes, etc.

BAKELITE — Mouldings of any shape or form, Tubes, Plates, Washers, Sheets in all thicknesses, etc.

Send to the Manufacturers:

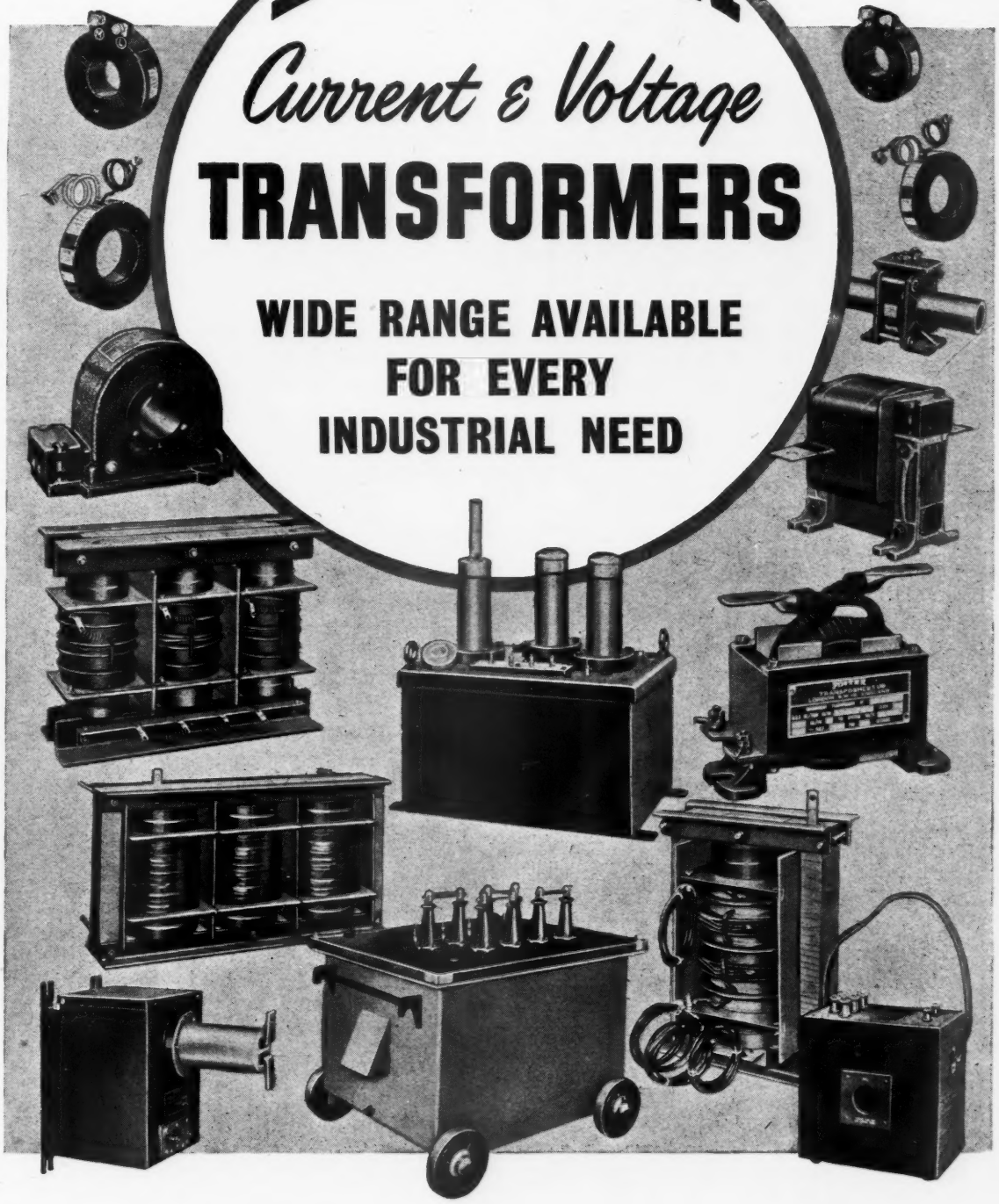
THE BIRMINGHAM MICA CO. LTD.
South Road • Hockley • Birmingham
Phone: Northern 5631/2 *Telegrams: "Insulation, Phone, Birmingham"*

FOSTER

Current & Voltage

TRANSFORMERS

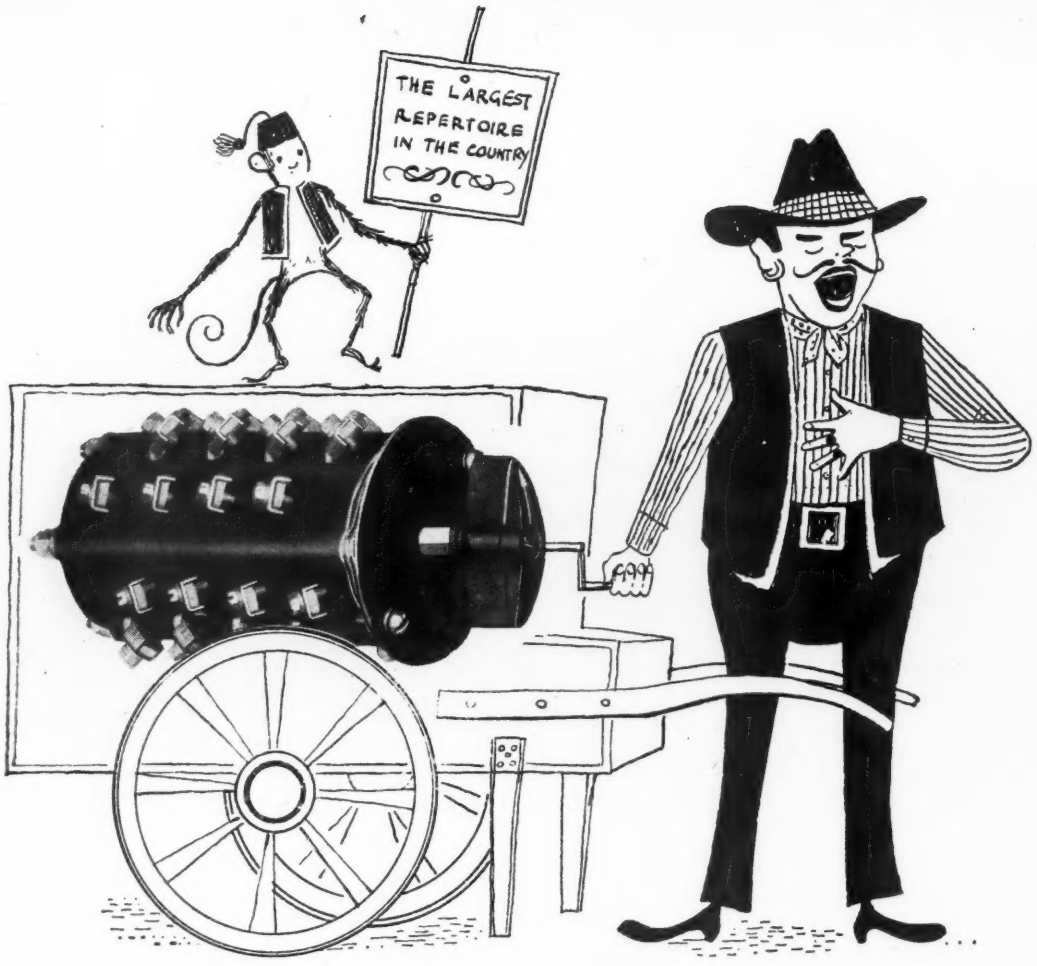
WIDE RANGE AVAILABLE FOR EVERY INDUSTRIAL NEED



FOSTER TRANSFORMERS LTD SOUTH WIMBLEDON LONDON SW19

A 'LANCASHIRE DYNAMO HOLDINGS' COMPANY

TR/2



You calla da tune...

We can play any number of variations on the Austinlite Rotary Switch. Say what you want a switch to do and Austinlite will supply the switch to do it . . . simply. Simplicity is the keynote of Austinlite Rotary switching; it saves contactors, interlocks, sequence relays, space, wiring, maintenance . . . and money — because every Austinlite switch is built for its job.

If you would like to know more about how and why, send for a copy of 'Simplified Switching'. It is post free on request.

Rotary switching is 'Simplified Switching'

ask *Austinlite* about it

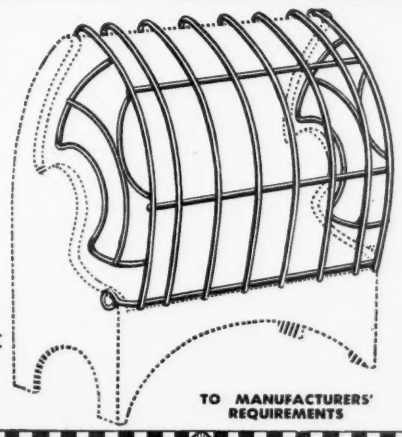
AUSTINLITE LIMITED, LIGHTHOUSE WORKS, SMETHWICK 40, BIRMINGHAM

(A subsidiary of Stone-Chance Ltd., the makers of Sumo Pumps and Stone-Chance Lighthouses.

WIRE GUARDS

TO

BRITISH STANDARD SPECIFICATION



FOR ELECTRIC FIRES

FOR ELECTRIC HEATERS

TO MANUFACTURERS' REQUIREMENTS

H·W·CARTER & JAMES LTD

BALSALL HEATH WIREWORKS, WENMAN STREET

BIRMINGHAM, 12

CAL. 1733 "WIRING" B'HAM

ALWAYS AT YOUR SERVICE WITH

1000 REPLACEMENT ELEMENTS

We shall be glad to send you copies of our ILLUSTRATED CATALOGUES

MYK/2/ER Elements & Spirals. DAR/2/ER Immersion Kettle Elements. JYL/30/ER Industrial Elements. Please indicate which lists required.

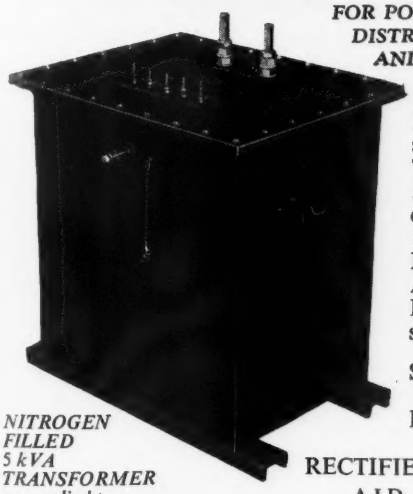
METWAY ELECTRICAL INDUSTRIES LTD.

METWAY WORKS, CANNING STREET, BRIGHTON 7

Phone: Brighton 28366 Grams: Metway Phone Brighton

TRANSFORMERS

FOR POWER DISTRIBUTION AND ELECTRONIC APPLICATION



NITROGEN FILLED 5 kVA TRANSFORMER as supplied to : A.E.R.E. HARWELL

Ranges from small Electronic Types, up to 50 kVA, orthodox and C cores. 1-Phase and 3-Phase Oil and Air Cooled Phase Conversion, etc.

Special Types for FURNACE and RECTIFIER CONTROL

A.I.D. and A.R.B. APPROVED

Your enquiries are invited

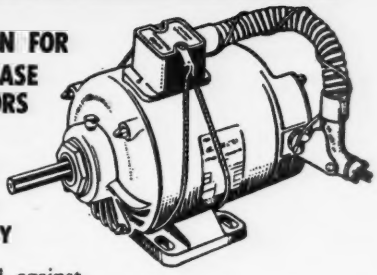
AVIS & BAGGS LTD.

GOSBROOK ROAD, CAVERSHAM, READING

Phone : READING 71763

THE OTTER MOTORGUARD

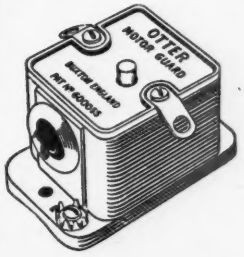
PROTECTION FOR SINGLE PHASE A.C. MOTORS



$\frac{1}{8}$-1 H.P. CAPACITOR AND SPLIT PHASE ONLY

Otters guard against temperature and current overload, the starting current is carried by the thin Otter Bi-metal, which heats up more quickly than the motor windings. It cannot be fused.

List 21/7d.



MANUAL RESET

Affords similar protection to the Auto, but upon "breaking" circuit will remain "off" until reset by pressing the Green knob. List 31/7d.

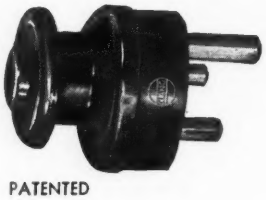
OTTER CONTROLS LTD

MARKET STREET, BUXTON Tel.: Buxton 1619

CLANG
Registered Trade Mark
LTD.

BY POPULAR DEMAND !

THE *NEW* 5 AMP
EJECTOR PLUG



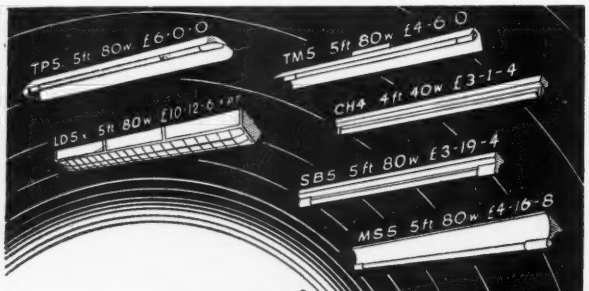
PATENTED

Manufacturers of over 300 different

Electrical Accessories

CRICKLEWOOD, LONDON, N.W.2

Phone: GLADSTONE 4201 P.B.X.



HIGH COSTS? Then change to Morlite Fittings

★ All fittings available in other lengths and with twin tubes

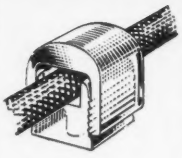
★ All fittings carry a two year unconditional guarantee.

★ Generous Trade & Quantity Discounts

★ Illustrated catalogue on request

MORLEY'S Electrical Services (HOLLOWAY) Ltd.
117 HORNSEY RD. LONDON N.7 · PHONE NORTH 5008

EL-CLEAT makes your wiring neat



Designed for neatness, speed and efficiency in the method of cleating wires, cable and flex of varying sizes.
Available in a colour range of transparent plastic material.
EL-CLEATS are used by leading manufacturers and contractors the world over.

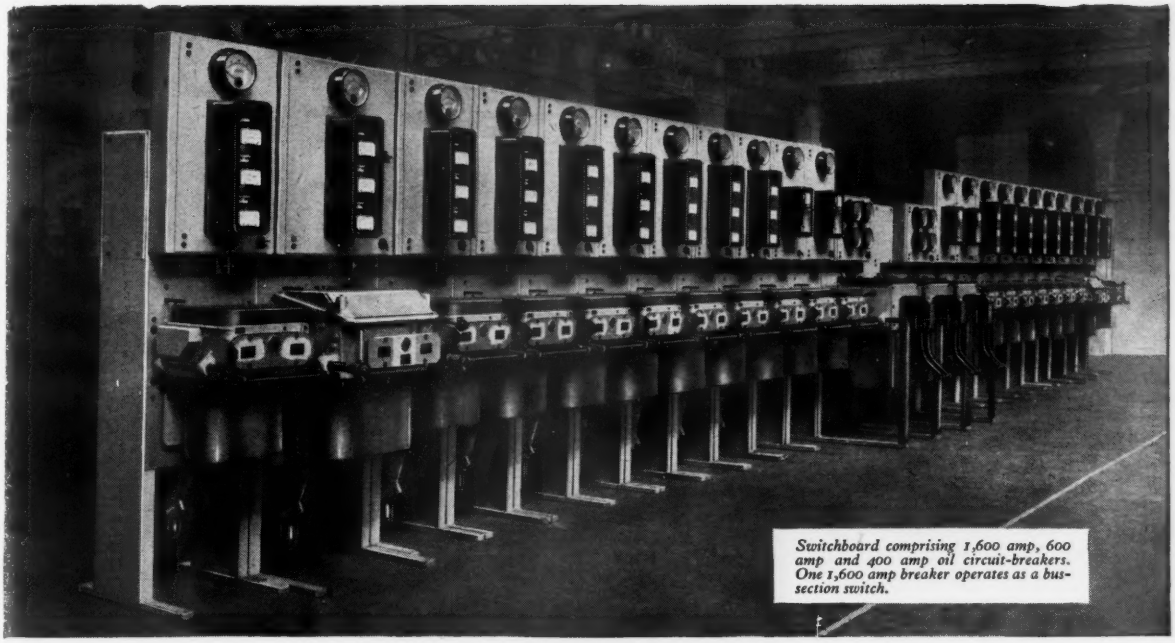
Send for Details and Samples:

J. A. B. JACOBSEN LTD., 22/24 Ritherdon Rd., London, S.W.17
Tel.: BALham 4697 and 5668 *Cables: "TEXCOM"*

HOUSE SERVICE METERS

Credit Pattern
and Prepayment Type
200-240 v. A.C. S/Ph 50 c. (& D.C.)
AVAILABLE FROM STOCK
POLYPHASE 400-440 v. 3-Wire Type
Ex Stock

UNIVERSAL ELECTRICAL CO.
217-221 City Road, London, E.C.1

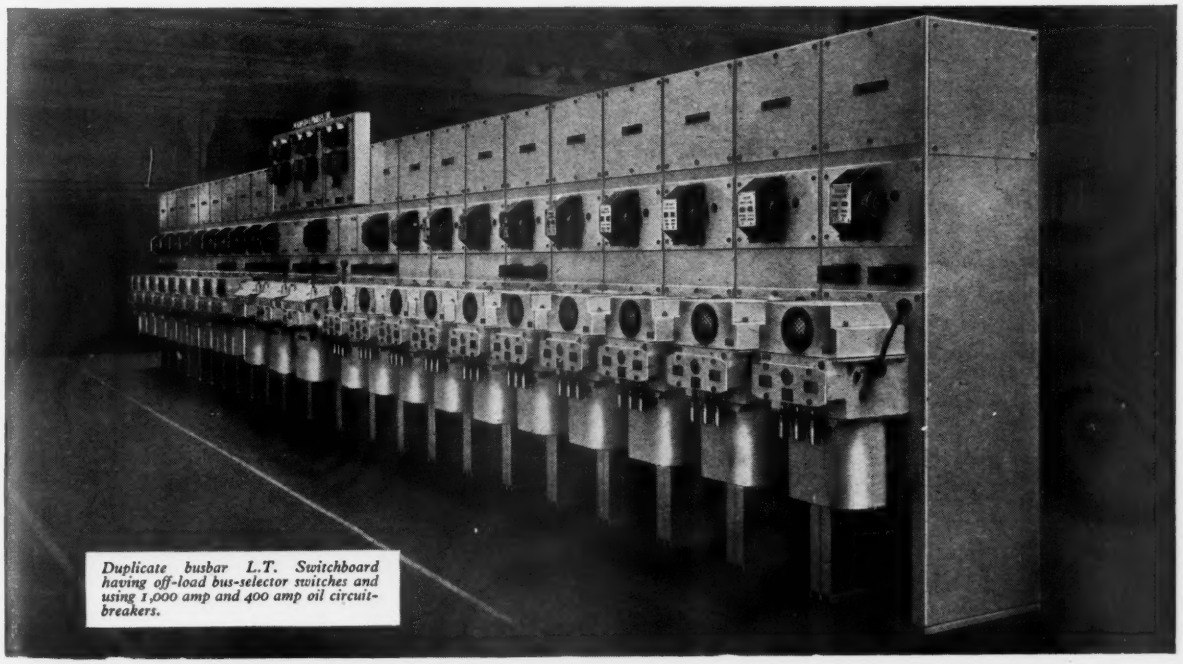


Switchboard comprising 1,600 amp, 600 amp and 400 amp oil circuit-breakers. One 1,600 amp breaker operates as a bus-section switch.

J. & P. LOW VOLTAGE SWITCHGEAR

These two switchboards supplied to the Iraq Petroleum Company are typical of J. & P. low voltage oil-break switchgear. Designed and A.S.T.A. certified for ratings up to 2,000 amp, 30 MVA, this gear can be supplied with horizontal isolation if required. Power closing mechanisms are available for the higher current ratings and rupturing capacities.

JOHNSON & PHILLIPS LTD., CHARLTON, LONDON, S.E.7



Duplicate busbar L.T. Switchboard having off-load bus-selector switches and using 1,000 amp and 400 amp oil circuit-breakers.

G.E.C.

33kV METALCLAD SWITCHGEAR

- All components readily accessible.
- Breaker maintenance within the unit.
- Complete phase separation within the breaker.
- Pedestal centres 3 ft. 9 ins.

THE GENERAL ELECTRIC COMPANY LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

CLASSIFIED ADVERTISEMENTS

ADVERTISEMENTS are accepted up to **First Post on Monday** of the week of issue (*see notice below for 31st December*), and should be addressed to Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.1.

CLASSIFIED advertisements are PREPAID at 3/- per line (approx. 6 words) per insertion. Where an advertisement includes a Box Number this counts as two words and carries an additional charge of 1/-.

DISPLAYED:—£2 per inch, per insertion. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

Original testimonials should not be sent with applications for employment

CHRISTMAS

Classified Advertisements for 31st December have now closed for press.

OFFICIAL NOTICES, TENDERS, ETC.

BOROUGH OF SCUNTHORPE

Lighting Improvements

TENDERS are invited for the supply of reinforced concrete columns, mercury discharge lanterns and ancillary gear, and the erection and wiring of 52 25-ft. columns and 14 15-ft. columns.

Contract documents may be obtained from, and drawings inspected at the office of, the Borough Surveyor, Mr. Cyril Cooper, M.I.C.E., Comforts Avenue, Scunthorpe, Lincs, on payment of a returnable deposit of £2 2s.

Tenders in the envelopes provided must be received by the undersigned by 12 noon on Wednesday, 12th January, 1955.

W. P. ERRINGTON,
Town Clerk.

Municipal Offices,
34, High St., Scunthorpe.
13th December, 1954. 6699

CITY OF BATH

Spa Committee

Electrical Installation at the Pump Room

TENDERS are invited for the renewal of the Electrical Installation of the Pump Room, basement and certain other rooms.

Application for the specification and form of tender and drawings should be made to J. F. Bevan Jones, A.R.I.C.S., Surveyor of Corporate Property, Guildhall, Bath.

The application should be accompanied by a deposit of £2 2s., which will be refunded on receipt of a bona fide tender.

Tenders, sealed in the envelope provided, are to be delivered to the Town Clerk's Office not later than Thursday, 13th January, 1955.

JARED E. DIXON,
Town Clerk.

Guildhall,
Bath. 6724

WILTS COUNTY COUNCIL

TENDERS are invited for installation of Electrical System at St. Thomas's New Secondary Modern School, Salisbury.

Applications, with a deposit of £2 2s. (cheques only, payable to the Wilts County Council) to be made by Wednesday, 12th January, 1955, when plans and specifications will be issued.

Tenders in envelopes provided, bearing no mark indicating origin, returnable by first post on Wednesday, 2nd February, 1955.

No pledge is given to accept the lowest or any tender.

P. A. SELBORNE STRINGER,
Clerk of the County Council.

County Hall,
Trowbridge. 6726

CITY OF CARLISLE

SEPARATE tenders are invited for the supply and delivery of the following:—

(a) 74 3/80-w. Fluorescent Lanterns complete with control gear and time switches.
(b) 71 Class A M.V. Lanterns complete with control gear and time switches.
(c) 144 25-ft. mounting height Steel Columns.
(d) The erection of 144 Columns, including wiring and fitting.

Particulars from City Engineer.
Closing date 17th January, 1955.

H. D. A. ROBERTSON,
Town Clerk.
6718

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through the Local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order, 1952.

NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT OF THIRD ASSISTANT ENGINEER (MAINS), CONSTRUCTION) SECTION, CHIEF ENGINEER'S DEPT., AREA BOARD HEADQUARTERS, MANCHESTER, 8. Applicants should have had experience in the design, erection and installation of overhead and underground mains up to and including 33 kV.

Experience in estimating will be considered an advantage.

Applicants should have obtained the H.N.C. in Electrical Engineering or hold an equivalent qualification.

Commencing salary according to qualifications and experience within range £750-£875 p.a., rising subsequently to £975 p.a., Class AX/EX, Grade 4. N.J.B. conditions.

Applications to Establishment Officer, North Western Electricity Board, Cheetwood Road, Manchester, 8, by 8th January, 1955.

APPOINTMENT OF (a) GENERAL ASSISTANT ENGINEER (WORKSHOP SUPERVISOR), (b) GENERAL ASSISTANT ENGINEER (APPLIANCE TESTING), DOMESTIC APPLIANCE WORKSHOP, WALKDEN.

Applicants for post (a) should have experience of supervising the mechanical and electrical repair and overhaul of all types of electrical appliances, and experience of machine tools and general workshop equipment.

Applicants for post (b) should have experience of routine and type testing and be capable of preparing reports dealing with the construction and performance of all types of electrical appliances.

Salary scales (both posts) £715 × £15 to £760 p.a., Grade L.13. N.J.B. conditions.

Applications to the Sub-Area Manager, No. 2 Sub-Area, North Western Electricity Board, National Buildings, St. Mary's Parsonage, Manchester, 3, by 5th January, 1955.

Note.—Persons who applied in response to the previous advertisements of the above posts need not re-apply.

APPOINTMENT OF SENIOR SERVICE CENTRE ASSISTANT (MALE), CARLISLE DISTRICT. Applicants should be of good educational standard and should preferably have obtained the E.D.A. Salesmanship Diploma. Experience in the supervision of service centre staff, publicity, window dressing and service centre stock control is essential. Experience in exhibition work would be an added advantage.

Salary scale £545/£605 p.a., Grade 3. N.J.C. conditions.

Applications to Sub-Area Manager, North Western Electricity Board, No. 6 Sub-Area, Castle Green, Kendal, by 5th January, 1955.
6700

ELECTRICAL DESIGNER/DRAUGHTSMEN

with National Certificate (Electrical) standard of education and experience in the design of lighting and power layouts in large industrial plants, are required in London office of major consulting and contracting engineers to the oil and chemical industries.

Posts are permanent and carry progressive salaries with sickness, pension and life insurance benefits.

Applications in writing should be addressed to Personnel Manager, Kellogg International Corporation, 7-8, Chandos Street, London, W.1.
6642

BRITISH ELECTRICITY AUTHORITY

London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A. Salary includes London allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

ASSISTANT ENGINEER (INSTRUMENTS):—

(a) BANKSIDE GENERATING STATION (Vacancy No. 54/1065).
(b) BRUNSWICK WHARF GENERATING STATION (Vacancy No. 54/1066).

Experience of all types of instruments necessary with experience of automatic boiler control equipment an advantage.

(a) Salary Class H, Grade 12 = £666 15s. per annum.
(b) Salary Class K, Grade 14 = £666 15s. per annum.

(Previous applications for these posts will be considered.)

ASSISTANT ENGINEER (ELECTRICAL TESTING), FULHAM GENERATING STATION (Vacancy No. 54/1067). Practical experience in the testing and routine maintenance of generating station electrical equipment, including generators, switchgear, transformers, motors and associated protective equipment is essential. Salary Class K, Grade 12 = £750 15s. p.a.

ASSISTANT ENGINEER (EFFICIENCY AND TEST), FULHAM GENERATING STATION (Vacancy No. 54/1068). Candidates should have received a sound technical education and possess knowledge of technical records in a modern power station, also experience with testing of power station plant. Salary Class K, Grade 14 = £666 15s. p.a.

Applications, quoting vacancy number, may be made on form obtainable from Divisional Secretary, British Electricity Authority, London Division, P.O. Box 136, Generation House, Great Portland Street, London, W.1, and be received within 14 days of this advertisement.
6702

ADMIRALTY, BATH

require

TEMPORARY ELECTRICAL DRAUGHTSMAN TRAINEES. British subjects only, aged 21 and over, and having served apprenticeship or had equivalent workshop experience in one or more branches of electrical engineering in factories or shipyards.

Free training in drawing and electrical technical knowledge, beginning February, 1955, at Bath Technical College, before grading as draughtsmen. Normal salary during training.

Salary according to age, qualifications and experience, £400 at 21 to £550 at 28, thence to maximum of £640.

Apply, giving details of qualifications and experience, to any Employment Exchange, quoting Bath 1321. 6676

SOUTH EASTERN ELECTRICITY BOARD

DISTRICT COMMERCIAL ASSISTANT (N.J.C.), Eastbourne District. Salary £485 × £20 to £545 p.a. under N.J.C. Grade 2. Superannuable.

Applicants should have experience in negotiating supplies, load development, consumers' services, tariffs, sales of electrical appliances, and organisation of exhibitions.

Applications, naming 2 referees, on forms from J. E. Winborne, District Manager, SEEBoard, Electric House, Grove Rd., Eastbourne, by 5th January, 1955.

A. L. BURNELL,
Secretary. 6702

THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY
Aldermaston, Berks

ASSISTANT EXPERIMENTAL OFFICERS required as follows:—

POST 1 (288/WGE/48). For experimental work on detection and estimation of low levels of radio-active materials in liquid effluents. The minimum qualification is Higher School Certificate or equivalent. A good knowledge of inorganic chemistry is essential, and practical experience on general chemical analysis would be an advantage.

POST 2 (323/WGE/48). To assist in a section responsible for the proof firing of initiators, the associated computational work, and for the modification and operation of electronic gear to meet special experimental requirements. The minimum qualification is Higher School Certificate (Science) or equivalent, with experience in the operation and adaptation of electronic timing gear in the microsecond range. Experience in the handling and setting up of experimental explosive charges and a knowledge of elementary statistics would be an advantage.

The salary scale for Assistant Experimental Officer is £288 10s. (at age 18) to £640 (Male) per annum.

The successful applicants will be required to join the Authority's Principal Superannuation Scheme to be introduced shortly, and the salary scale quoted above will be enhanced to cover contributions.

Houses available within a reasonable period for married officers who live outside the radius of the Establishment's transport facilities.

Application form from Senior Recruitment Officer, A.W.R.E., Aldermaston, Berks. Quote appropriate ref. 6677

AIRCRAFT ELECTRICAL INSTALLATIONS

THE BRISTOL AEROPLANE COMPANY Limited at Filton requires to recruit the following staff into the Electrical Section of their Aircraft Design Office:—

(a) AIRCRAFT ELECTRICAL DESIGN ENGINEERS, who have a degree in electrical engineering or equivalent qualifications and experience in the design of aircraft electrical components and installations.

(b) ELECTRICAL LAYOUT & CIRCUIT DRAUGHTSMEN, who have the H.N.C. or O.N.C. in Electrical Engineering, or the equivalent City and Guild's qualifications, or who have served an apprenticeship in electrical engineering.

Selected draughtsmen without experience of aircraft electrical design work will be considered for training.

Applications, giving details of experience, qualifications and salary required, quoting D.O.29, should be addressed to the Personnel Manager, The Bristol Aeroplane Co. Ltd., Aircraft Division, Filton House, Bristol. 6582

ELECTRICAL AND MECHANICAL ENGINEERS

SUNVIC CONTROLS LTD. (a subsidiary of Metropolitan-Vickers Electrical Co. Ltd.) have the following vacancies in their new Development and Production Units at Harlow.

(1) GRADUATE ENGINEER with general works training and experience on the design of domestic control equipment. Applicants must be familiar with modern methods of manufacture and have some knowledge of mass production techniques.

(2) GRADUATE ENGINEER with experience in design or development of electro-mechanical mechanisms and their application to instrument problems.

The above positions are permanent and offer excellent prospects for promotion in a team engaged on the development and manufacture of a wide range of new instruments. Salaries will be according to age and ability. The company's contributory pension scheme applies in all cases, and housing is available if required.

Reply in writing, giving full particulars of age, experience, qualifications and present situation, to Chief Engineer, Sunvic Controls Ltd., Harlow, Essex. 230

ELECTRICAL ENGINEERS (DISTRIBUTION)

required by the CENTRAL ELECTRICITY BOARD, MALAYA. Salary scale (including expatriation pay and present temporary allowance at rate for single men) equivalent to £1,197 rising to £2,100 a year. Commencing salary according to qualifications and experience. Additional temporary allowances totalling £210/£399 a year (married men) and £301/£630 (family men).

Option of appointment either (a) on agreement for three years with prospect of permanency or (b) on contract for three years with gratuity of £200/£280 a year. Opportunity of terminating appointment after one year's service. Free passages. Liberal leave on full salary.

Candidates must have had sound training in both electrical and mechanical engineering, with experience in the operation of medium electricity supply undertakings, and possess a competent knowledge of the maintenance of high and low-tension overhead and underground A.C. distribution systems and substation plant. They should preferably be Corporate Members or Graduates of the Institution of Electrical Engineers or possess degrees or other qualifications carrying exemption from the Institution's graduate examination.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2A/40440/EF. 6690

PHILIPS ELECTRICAL INDUSTRIES

have the following vacancies for men in their Central Purchasing Organisation, which is located at Mitcham:—

1. ASSISTANT MAINTENANCE BUYER who should be used to the routine of a purchasing department and be experienced in obtaining the requirements of a large factory maintenance department. Young man preferred.

   Commencing salary according to experience and ability, but not less than £475 per annum.

2. EXPEDITER, age 21 to 25, preferably with a knowledge of maintenance problems. Commencing salary according to age and experience and not less than £420 per annum.

Please apply in writing to the Personnel Officer, The Mitcham Works Ltd., New Road, Mitcham Junction, Surrey, quoting reference J.2.

6678

BRITISH ELECTRICITY AUTHORITY
East Midlands Division

APPLICATIONS are invited for the following position within the Division: SHIFT CHARGE ENGINEER, AVON POWER STATION, WARWICK (Vacancy No. 186/54/ER).

Applicants should be suitably qualified and have had experience in the operation of modern boiler and turbine plant.

Salary in accordance with Class E, Grade 7 (£715 × £15 to £760 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 30th December, 1954.

This appointment will be pensionable within the terms and provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form A.E.6/ACT, which may be obtained from the Divisional Establishments Officer, British Electricity Authority, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote vacancy number.

L. F. JEFFREY,
Divisional Controller.
6701

ADMIRALTY

TEMPORARY PRODUCTION INSPECTORS required with experience in either Mechanical, Electrical, Electronic or Marine Engineering, including experience in water tube boiler work associated with marine or land installations, for various places in the United Kingdom. Duties include production methods, inspection, test, installation and the preparation of technical handbooks.

Candidates, at least, 25, should have recognised engineering apprenticeship or equivalent training plus at least three years' relevant experience in industry or Government service; H.N.C. or equivalent, but O.N.C. or equivalent considered. Ex-service personnel with appropriate training and experience eligible to apply.

Appointments unestablished but opportunities may occur later to compete for permanent posts.

Inclusive salary scales £665 to £780 per annum, entry at minimum less about £20 for each year by which age falls short of 30. Salaries outside London somewhat lower.

Application forms from M.L.N.S., Technical and Scientific Register (K), 26, King Street, London, S.W.1, quoting D.615/54-A. Closing date 8th January, 1955. 6675

SOUTH WEST SCOTLAND ELECTRICITY BOARD
Ayrshire Sub-Area
Third Assistant Engineer, Planning and Development

APPLICATIONS are invited for the position of THIRD ASSISTANT ENGINEER (Planning and Development) at Sub-Area Headquarters, Kilmarnock.

Applicants should be experienced in the design of modern H.V. and L.V. distribution systems and of protective equipment. They should be Graduate Members of the I.E.E. or possess equivalent qualifications.

Salary and conditions will be in accordance with the National Joint Board Agreement, Class G, Grade 10, £675/£720 per annum, subject to statutory deductions including income tax and superannuation.

Forms of application may be obtained from the undersigned or any other Sub-Area Manager and should be returned to me duly completed with any additional information not later than 5th January, 1955.

A. E. ROOTS,
Manager.
Greenholm Street,
Kilmarnock.
13th December, 1954. 6717

THE GENERAL ELECTRIC CO. LTD.
Witton, Birmingham, 6

VACANCIES for DRAUGHTSMEN. The company offers varied and interesting careers to senior and junior draughtsmen experienced in any of the following:—

SWITCHGEAR: Airbreak circuit breakers; H.T. circuit breakers and metalclad switchgear; switch and control board layout; industrial control contactor cubicles; diagrams.

ROTATING MACHINES: Large A.C. and D.C. machines, including turbo and water-wheel alternators.

Five-day week. Superannuation scheme. Excellent conditions. Apply giving full details to the Staff Manager. 6487

QUALIFIED ENGINEER

ABLE young QUALIFIED ENGINEER required by CIBA LABORATORIES LIMITED for their rapidly expanding modern pharmaceutical factory in Sussex. Opening provides scope for substantial development. Age under 35. Excellent conditions of employment, including pension fund. Initial help with housing for married man. Send details of education, qualifications, industrial experience and salaries earned to

Works Manager
CIBA LABORATORIES LIMITED
Horsham, Sussex

6525

SOUTHERN ELECTRICITY BOARD

Junior Engineer

SWINDON District of No. 2 (Newbury) Sub-Area. Salary N.J.B. Class F, Grade 14 (£475/£520 per annum). N.J.B. conditions of service.

The duties of the post will be to assist with distribution, including minor construction work and general maintenance. Applicants should have received technical training to O.N.C. standard and have experience of similar work.

The successful candidate will be required to contribute to the B.E.A. and Area Boards Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, 7, Oxford Road, Newbury, and returned to him in envelopes suitably endorsed not later than 8th January, 1955. 6719

ELECTRICAL ENGINEER

APPLICATIONS are invited from ambitious Electrical Engineers under 30 years of age for the post of DESIGN ENGINEER (Electrical) at Davy and United Engineering Company Limited, manufacturers of hot and cold rolling mills, presses, etc.

A knowledge of rolling mill electrical equipment and experience with a large electrical manufacturer desirable. Minimum qualifications Higher National Certificate.

Applications, stating age, qualifications, experience and salary required, should be sent to Personnel Officer, Davy and United Engineering Company Limited, Park Iron Works, Sheffield, 4.

6679

BRITISH ELECTRICITY AUTHORITY

South East Scotland Division

GENERAL ASSISTANT ENGINEER (Transmission) required for the Southern Transmission Section at Melrose Road, Galashiels.

Applicants should possess Higher National Certificate in Electrical Engineering or equivalent qualifications, and preferably have had some works training or experience in construction of H.V. substations.

Salary scale £600-£745 (N.J.B. Class AX/BX/6). Placings according to experience. Pension scheme.

Apply in writing by 4th January, 1955, to Divisional Controller, British Electricity Authority, South East Scotland Division, British Electricity House, High Street, Portobello, Midlothian. 6720

TOOL ENGINEER REQUIRED

COMPANY situated in Lanarkshire and engaged in large quantity production of small apparatus requires the services of a TOOL ENGINEER experienced in such production, particularly in the design of multi-stage press tools. Write giving experience and salary required — 14X7, Wm. Porteous & Co., Glasgow.

6692

ELECTRICAL ENGINEER-DRAUGHTSMAN URGENTLY REQUIRED

ASSISTANT ENGINEER - DRAUGHTSMAN, preferably with some experience of battery-electric traction units, D.C. switchgear, etc., required in design office of well-known manufacturers of fork lift trucks and battery electric vehicles.

Apply in confidence, giving full details of experience, qualifications, and salary required, to:

Chief Designer,
AUSTIN CROMPTON PARKINSON ELECTRIC VEHICLES LIMITED,
Webb Lane, Birmingham, 28. 224

SOUTH WALES ELECTRICITY BOARD

CIVIL ENGINEERING DRAUGHTSMAN, Civil Engineering Department, Head Office, St. Mellons.

Applicants should have a sound knowledge of reinforced concrete design and be capable of preparing complete working drawings for substations and buildings applicable to the electricity supply industry.

Salary Grade 5 (£640/£740) of Schedule D of N.J.B. Agreement.

Applications stating age, present position and salary, qualifications, experience, and three referees, to be addressed to the Secretary to arrive by 8th January, 1955.

D. G. DODDS,
Secretary.

St. Mellons, Cardiff. 6704

SOUTH WALES ELECTRICITY BOARD

TWO ARCHITECTURAL DRAUGHTSMEN, Civil Engineering Department, Head Office, St. Mellons.

Applicants will be required to undertake the layout and preparation of working drawings for showrooms, offices and substations, including measuring up and alterations to existing buildings.

Salaries Grade 6 (£510/£630) of Schedule D of N.J.B. Agreement.

Applications stating age, present position and salary, qualifications, experience, and three referees, to be addressed to the Secretary to arrive by 8th January, 1955.

D. G. DODDS,
Secretary.

St. Mellons, Cardiff. 6705

BRITISH ELECTRICITY AUTHORITY

RESEARCH LABORATORIES, Leatherhead, require TWO GENERAL ASSISTANT ENGINEERS. Candidates should have a university degree or equivalent qualifications in electrical engineering or in physics.

Duties include research on electrostatic precipitation and allied problems at Leatherhead and Croydon Laboratories.

Salary N.J.B. Grade 4, £675-£850 p.a.

Applications stating age, qualifications, experience and present position and salary should be forwarded to D. Moffat, Director of Establishments, Winsley Street, London, W.1, by 17th January, 1955. Quote reference ER/541. 6691

SURREY COUNTY COUNCIL

APPLICATIONS are invited for appointment of ASSISTANT ELECTRICAL ENGINEER, Grade IV, £675 × £30 to £825 p.a., plus London weighting. Should be Corp. Members I.E.E. and experienced in preparation of schemes, specifications, drawings and estimates for, and supervision of, installations of electrical services in large buildings.

Full details of present and previous appointments and salary attaching thereto, accompanied by copies of 3 recent testimonials, to County Architect, County Hall, Kingston, by 31st December, 1954. 6725

TRANSFORMER DRAUGHTSMAN

required for factory in Bridgend, Glamorgan. Experience in transformers up to 2,000 kVA, 33 kV, essential. Holidays with pay. Pension scheme. A new three-bedroomed house 2 miles from factory, 5 miles from Porthcawl, available for successful applicant. Apply — London Transformer Products Limited, L.T.P. Works, Cobbold Estate, Cobbold Road, Willesden, London, N.W.10. 6455

A VACANCY has occurred for the position of senior electrical engineer with first-class qualifications on the staff of a well-known electrical contracting firm in Cardiff. Experience of contracting, as opposed to manufacturing, essential. Write stating education, qualifications, age, experience and salary required, to—Box 6693.

AN experienced D.C. designer capable of using his initiative required for interesting work on dynamo electric machines from 5 to 5,000 h.p./kW. A superannuation scheme in operation and the usual social amenities available in an organisation of progressive outlook. All applications will be treated with the strictest confidence and should be addressed to—The General Manager, Lancashire Dynamo & Crypto Ltd., Trafford Park, Manchester, 17. 6219

ASSISTANT electrical engineer for power station construction in South Wales. Must be familiar with electrical testing and commissioning procedure. Salary according to experience. Write — Box E.R.660, c/o 191, Gresham House, London, E.C.2. 6706

BRITISH INSULATED CALLENDER'S CABLES Ltd. require an assistant technical writer for the assembly and scrutiny of technical matter required for the company's catalogues. Candidates should possess a methodical mind capable of co-ordinating detail and at the same time the breadth, imagination and initiative necessary to build up a first-class technical presentation of the company's products. Further qualifications should include technical training to H.N.C. standard or equivalent and preferably some experience of the cable making industry. Applications should be submitted in writing to the undersigned, quoting reference No. P/67/54, Staff Officer, B.I.C.C. Ltd., Prescot, Lancs. 6727

BRUSH ELECTRICAL ENGINEERING Co. Ltd., Loughborough, Leics, has a vacancy for a research engineer to assist with projects connected with high-voltage technology and the development of power transformers. A good degree in electrical engineering or physics is necessary, with experience of transformer design, manufacture, associated techniques. Consideration will be given to candidates with suitable educational qualifications and experience of research in kindred fields who wish to develop further knowledge and experience in this important work. Existing facilities provide opportunities for original research. Please write with full details to—The Chief Personnel Officer. 6619

CABLE estimator required, age about 25 years, with experience in cable design and works estimates. Central London area. Please send full details to—Box 6710.

CHEMIST required by a firm of electric cable manufacturers in the North-West area. Experience in rubber cable manufacture preferred but not essential. Superannuation fund and 5-day working week. Reply stating age, experience and salary required to—Box 5994.

CONDUIT fittings. Agents required for (a) London area, (b) Lancashire and Yorkshire, to sell to the wholesale trade. Good opportunity for young man willing to work. Remuneration by commission only.—Box 7774.

CONTRACTORS require fully experienced L.T. and E.H.T. cable jointers for work in Midland area. Able to drive an advantage. Please apply in the first instance to—Box 6601.

CROMPTON PARKINSON Ltd. invite applications from senior and junior switchgear engineers for posts in their Chelmsford works. Vacancies exist in both contract and tender sections of the switchgear department. State age, experience, qualifications and salary required to—The Personnel Officer, Crompton Parkinson Ltd., Chelmsford, Essex. 239

DESIGN draughtsman. A vacancy exists in our design drawing office for a first-class designer for interesting work in connection with the development of automobile electrical equipment. He should be at least of H.N.C. standard and experience in the design of light electrical equipment for large quantity production would be an advantage. A good starting salary will be paid and the position provides excellent scope for advancement. In addition, design and detail draughtsmen are also required for the design of aircraft and automobile wiring systems, and applicants for these positions should have experience in the layout of electric circuits. Please reply stating age, qualifications and experience to—Personnel Manager, Joseph Lucas (Electrical) Ltd., Great King Street, Birmingham, quoting ref. PM/D/41. 143

DESIGN engineer required with experience in rectifiers, motor drives and magnetic controls. Good salary and pension. Apply, with details of training, experience, etc., to—Nevelin Electric Company Ltd., Purley Way, Croydon, Surrey. 6680

DRAUGHTSMAN required by consulting engineers for the reproduction of electric light and power schemes. Previous experience essential. Write, stating age, experience and salary required, to—E. Wingfield-Bowles and Partners, 32, Old Queen Street, Westminster, London, S.W.1. 157

DRAUGHTSMEN wanted by makers of industrial electrical control gear, London area. Full details, experience, age, salary, to —Box 6711.

DESIGN engineer required for the development of outdoor type high-voltage isolating switches and fuse gear for 11 kV and above. Applicants must have had good drawing office training and experience in the design of similar equipment. Write, giving full particulars of experience, age and salary required, to—Box 6621.

DRAUGHTSMAN required by prominent firm in West London for preparation of lighting and power schemes for all types of buildings. Pension scheme, social and sports facilities. Apply stating age, experience and salary required to—Box 6443.

ELECTRIC lamp development engineer. Crompton Parkinson Limited have a vacancy in their lamp development and research laboratories at Guiseley for experienced lamp or radio valve technician, capable of carrying out specific investigations and development work on electric discharge lamps, etc. The position vacant offers good salary rates and good prospects of promotion. Preference given to graduate physicist or electrical engineer. Superannuation scheme. Write in confidence, with full details, to — Reference LLD, Crompton Parkinson Ltd., Guiseley, Nr. Leeds. 6603

ELECTRICAL designer required. Must have practical experience in the design of A.C. and D.C. motors, 1-200 b.h.p. Reply in confidence, stating age, experience, and salary expected.—Hugh J. Scott & Co. (Belfast) Ltd., Volt Works, Ravenhill Road, Belfast. 6645

ELECTRICAL draughtsman required for the electrical division of the engineering department of medium/heavy engineering industry. Should have experience in preparation of drawings for electrical installation work and circuit diagrams. Applications to—Personnel Manager, Ruston-Bucyrus Ltd., Excavator Works, Lincoln. 6604

ELECTRICAL engineer/draughtsmen required for interesting work on large chemical plant installations. Applicants should have some works experience in heavy industry and technical ability to deal with a large variety of problems. Duties include the preparation of power and lighting schemes. Generous salary commensurate with experience and ability. Five-day week and superannuation scheme in force. Applications, which will be treated in confidence, should give previous experience and qualifications and be addressed to—The Chief Draughtsman, Laporte Chemicals Ltd., Clifton House, Euston Road, London, N.W.1. 6708

ELECTRICAL foreman with wide production experience in radio industry of small and medium electrical control gear manufacture, test and installation required by manufacturers of materials handling vehicles in pleasant country district, 1 hour London. Good prospects of advancement; housing assistance; canteen and social facilities. Please write giving details of age, past experience, present salary, salary required, married/single, to—Box 6721.

ELECTRICAL wholesalers require order clerk used to taking orders by telephone. Electrical experience essential. — Supra Electrical Co. Ltd., 26, Soho Square, London, W.1 (Gerrard 4012). 6712

ELECTRICIAN required by London Electricity Board in Islington District of Northern Sub-Area. N.J.I.C. rates and conditions, 4s. 1d. p.h. Application forms from Personnel Officer, 46, New Broad St., London, E.C.2. Please enclose addressed envelope and quote ref. M/3576/R. 6707

ELLIOTT BROS. (LONDON) Ltd. invite applications for appointment as sales and contract engineer in their electrical measuring instrument division. Electrical engineering background to H.N.C. level and experience of quotation work in industry desirable. Applications in confidence to—The Personnel Manager, Century Wks, Lewisham, London S.E.18. 6597

ENGINEERING draughtsman, senior, capable electrical layouts required by London firm engineers. Excellent opportunity progressive situation. Write age, references.—Box 6535.

ESTABLISHED firm seeks services of ambitious young man, fully experienced fractional h.p. motor winding, repair and manufacture, to start up and develop branch S.E. London. Salary and share of profits basis.—Box 6536.

FOREMAN winder to take control of repair shop. Accommodation provided if necessary. Apply—Priory Electric Service (Coventry) Ltd., 3, Lower Ford Street, Coventry. 6559

FLAMESETTERS, preferably with previous experience of high-speed lamp-making machines (sealing, pumping and footmaking) required as group chargehands. Full details, stating age, experience and salary required.—Box 6584.

FULL-time representative required by well-established manufacturers of high-grade switches, to cover the Northern Counties of England. Pleasant personality and contacts with leading electrical manufacturers and area boards. Knowledge of switching applications, particularly packet, rotary and toggle switches, an advantage. Reply giving full details, including experience, remuneration expected, and whether a car owner, to—Box 6606.

GRADUATE mechanical engineer required to work on steam power plant design. Applicant must have at least five years' experience on the design and layout of modern high-pressure, high-temperature central stations. The company is now actively engaged in extensive plant extensions of 25 and 45 MW size, the latter 900 lb. 900° F. On a long-term basis opportunity is offered for advancement in both technical and executive lines of public utility work. Salary paid will be according to ability, academic qualifications and experience. Apply giving age, training experience and approximate salary required. Address applications to—N. T. Smith, Manager, Nova Scotia Light and Power Co. Ltd., Halifax, N.S., Canada. 6497

GRADUATES in electrical engineering or physics required by well-known cable manufacturers, near London, for research and development work on all types of H.V. cables. Pension scheme and other amenities.—Box 6457

JUNIOR draughtsman required for London office manufacturing and consultant electrical engineers. Write giving full particulars including salary required, to—Power Connectors Ltd., 2, Caxton Street, London, S.W.1. 7779

JUNIOR technical assistant required for illuminating engineering department of old-established manufacturers of lighting equipment for the preparation of lighting schemes, etc. Apply in writing stating age, experience and salary required to—Chief Engineer, Technical Service Dept., Holophane Ltd., Elverton St., Westminster, London, S.W.1. 6694

JUNIOR technical assistant required by London chartered patent agents with a view to training for qualifying as a patent agent. Degree standard in electrical or mechanical engineering. Write giving details of age, experience, etc., to—Box 3583, c/o Whites Ltd., 72, Fleet Street, London, E.C.4. 6713

LAYOUT draughtsman required by consulting engineers for electrical layout work, including E.H.V. and L.V. outdoor substations, indoor switchgear and cable diagrams. Salary in accordance with qualifications. Apply in writing, reference KJB/RFS, to Messrs. Kennedy & Donkin, 12, Caxton Street, London, S.W.1. 6714

LEADING oil company requires one electrical engineering draughtsman for work in London. Age 25 to 30 years. Candidate should possess the Ordinary National Certificate in Electrical Engineering or have equivalent qualification. Good practical experience required followed by 3 to 5 years in the drawing office on electrical installations for process plants, workshops and factories. He will have opportunities of visiting refineries for periods of temporary duty. Opportunities for promotion to engineering appointments occur within the company and with its associates both in the U.K. and overseas. Write giving full details, and quoting H.3261, to—Box 7142, c/o 191, Gresham House, London, E.C.2. 6709

MANCHESTER CORPORATION TRANSPORT DEPARTMENT. Technical assistant (electrical) required in the Chief Engineer's Section at a salary of £560/£640 per annum. Candidates should possess technical qualifications not less than the Higher National Certificate, and preferably Graduate Membership of the Institution of Electrical Engineers. Forms of application, together with full details of the duties attached to the post, can be obtained from the General Manager, Manchester Corporation Transport Department, 55, Piccadilly, Manchester, 1, and should be submitted to him with copies of not more than two recent testimonials, not later than Friday, 7th January, 1955. Canvassing is prohibited. 6695

LINESMEN required by contractors for work on H.T., L.T. and steel tower lines in the Midlands. Please apply in the first instance to—Box 6602.

OLD-established electrical wholesale company requires representative for Wolverhampton and Black Country area to call on industrial users. Substantial existing connection handed over to man of personality able to introduce additional trade. Own staff notified.—Box 6696.

OPPORTUNITY for man of wide experience of design and manufacture in the electric motor industry to take up an interesting position on the sales side of a medium-sized company whose product is selling widely at home and abroad. Position is progressive and pensionable. Apply, giving age, salary required, and experience in chronological order, to—Box 252.

OPPORTUNITY for young man with leanings towards the sales side of business and who has served an apprenticeship in the electrical engineering industry and obtained either the Ordinary or Higher National Certificate. A suitable candidate can enter a progressive manufacturing company with world-wide business. Good opportunity for a live and energetic man of good personality. Apply, giving age, salary required, and experience in chronological order, to—Box 253.

PAKISTAN: Electrical engineer. The General Electric Co. Ltd. has an opening in the contracts and installation department in Pakistan for an electrical engineer, preferably aged between 25 and 30. This vacancy requires an engineer who has served an apprenticeship with an electrical contracting firm and who has had practical experience in installation work in factories and commercial buildings. The work will consist of designing, estimating and executing installation work of all types. Appointment is on a contract for four years in the first instance, with six months' furlough at the end of that period. Apply in writing to the Staff Manager (Ref. P.E.), The General Electric Co. Ltd., Magnet House, Kingsway, London, W.C.2, stating age, qualifications and experience. 6681

PRODUCTION manager wanted by light electrical engineering firm in Bradford, Yorkshire. 700 employees. To be fully responsible for production planning and layout. Time and motion study and tooling. Please apply in the first instance giving qualifications, age and salary expected to—Box 6715.

PROGRESS manager. Opportunity occurs for a first-class man with some engineering experience and considerable energy and drive to join a progressive company in South-West London whose product is widely sold in the electrical engineering industry. Apply stating age, salary required, and experience in chronological order to—Box 254.

QUALIFIED design and development engineer required by small but expanding company manufacturing control switchgear, specialising in limit, micro and rotary switches, in Birmingham area. Excellent prospects for advancement. Write fully stating past experience, qualifications and age to—Box 6459.

SALES engineer, aged 30/35, for export department of leading manufacturers of electrical temperature control instruments, West London area. Engineering degree, Higher National Certificate or equivalent and sound practical experience both electro-technical and commercial are essential qualifications. Commencing salary £650 per annum.—Box 6682.

SALES engineer required for London and Southern Counties by progressive company manufacturing switchgear and distribution equipment. Applicants should preferably have had experience in the manufacture, installation and operation of distribution equipment for MV and HV systems. Write, giving full particulars of experience, age and salary required, to—Box 6620.

SENIOR estimator required with initiative and having experience in handling comprehensive enquiries involving rotating electrical machinery up to 5,000 h.p./kW. A superannuation scheme in operation and the usual social amenities available in an organisation of progressive outlook. Promotions inside and transfers to sales normally made from staff. All applications will be treated with the strictest confidence and should be addressed to—The General Manager, Lancashire Dynamo & Crypto Ltd., Trafford Park, Manchester, 17. 6218

SALES manager required for medium-sized firm of mechanical and electrical engineers in South-West London. Experience should include knowledge of design and manufacture of electric motors of all sizes, and it would be an advantage to have good contacts in this industry. The company has a wide home and export trade. Apply, giving age, salary required, and experience in chronological order, to—Box 255.

SENIOR or junior draughtsman required for work on electrical power resisters and large electrical heaters for industrial applications. Previous experience on this class of work is desirable but not essential. Apply giving full details, including age, technical qualifications, whether married or single, and salary required, to—The Expanded Metal Co. Ltd., Electrical Dept., Stranton Works, West Hartlepool. 6586

SENIOR plant efficiency engineer (boilers and auxiliaries) required in Manchester by consulting engineers. Candidates should have an engineering degree and be thoroughly conversant with the conduct and full supervision of efficiency trials on large power station boiler plants and their auxiliaries. A knowledge of fuel and chemical engineering would be an advantage. The position is superannuated. Please apply to—Staff Applications, Kennedy & Donkin, 813a, Wilmslow Road, Didsbury, Manchester, 20. 6627

TECHNICAL assistant (junior) required by industrial firm in West London. Must have qualifications to degree or A.M.I.E.E. standard, and some practical experience of installation work, H.V. and L.V. distribution, modern control gear, process control methods. Knowledge of electronics and illuminating engineering advantageous. Apply stating age, qualifications, experience and salary required to—Box 6697.

TELEPHONE engineer required by British-owned telephone administration operating in Portugal. Applications are invited from candidates who have specialised in development and planning of external plant and preference will be given to candidates with experience in lines and cable construction. They should have good organising ability and experience in controlling staff. Applicants should hold the qualifications required for Corporate Membership of the I.E.E. or the equivalent. Single preferably but not essential. Age approximately 30 to 35. Commencing salary, after local taxation, equivalent to approximately £1,150 per annum increased by 20% at the end of the second year with good steady prospects thereafter. Write particulars of qualifications and experience to—Box E.R. 653, c/o 191, Gresham House, London, E.C.2. 6644

TEST engineer, age 25-40, required by electrical engineering organisation specialising in the production of variable speed driving equipments for use in the printing industry. Previous experience with electronic equipment is essential, and some knowledge of variable output voltage rectifier equipment and/or variable speed A.C. motors would be an advantage. Write, stating age, experience and salary required, to—General Manager, Witton-James Ltd., The Hyde, Hendon, London N.W.9. 6722

TWO senior draughtsmen required immediately. This is an opportunity for men with progressive ideas to join in the development of an entirely new electro-mechanical product with an assured future. High salaries will be paid to the right men. Excellent working conditions, 5-day week, pension scheme, etc. Apply in writing—Brentford Electric Ltd., Kidbrooke Park Road, Kidbrooke, London, S.E.3. 6544

WELL-known electrical manufacturing company has a vacancy for a sales engineer for electrical rotating machinery in Sheffield. Successful applicant must be a trained electrical engineer with O.N.C. as a minimum qualification and with previous sales experience in the area covered. He will work from the company's existing branch office. Remuneration by salary and expenses. Non-contributory pension scheme.—Box 6446.

YOUNG electrical draughtsman for engagement on wide variety of installation work. Should be fully competent to design and draft lighting and power schemes for all types of buildings and to supervise site works. Good salary in accordance with experience. Previous knowledge of professional work not essential. Write in confidence giving particulars of age and experience to—A. J. P. Pashler, Consulting Engineer, 50 Newhall St., Birmingham 3. 7782

TRADE counter assistant or charge hand required with knowledge of the electrical wholesale trade. Apply in first instance by letter to Superlamp Ltd., 24a, St. Giles High Street, London, W.C.2, giving full details of past experience and salary required. 6542

YOUNG radio engineer with practical experience, for experimental and development work on interference suppression equipment to Ministry requirements, to work without supervision in laboratory and on site.—Aish & Co. Ltd., Poole. 6569

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

CABLE jointer and mate require contract work. Long and varied experience on all classes of cables. Splendid references.—Box 7784

ENGINEER (35), qualified and widely experienced in precision/instrument electro-mechanical/electronic design, development and liaison; seeks position in which ability, energy and loyalty can be well utilised.—Box 7778.

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Street Lighting Equipment

THE Council have the following secondhand Sodium Equipment and gear for sale:—

34 140-watt open type non-cut-off lanterns, top entry tapping.
24 do. for catenary suspension.
10 do. for top entry or catenary suspension.
67 cast-iron boxes for gear. Pole or wall mounting.
26 140-watt sodium leak transformers tapped 210, 220 and 230 volts.
30 20-mfd. condensers.

This equipment may be viewed by appointment during normal working hours, and tenders should be forwarded in a plain envelope endorsed "Tender for Street Lighting Equipment" so as to be received by the undersigned not later than first post on Saturday, the 15th January, 1955.

F. H. BUCKLEY,
Clerk of the Council.
Town Hall,
Whitefield, Lancs.
17th December, 1954. 6723

ELECTRIC MOTORS, 400/3/50

650-h.p. S/R, MATHER & PLATT, 737 r.p.m., two pedestal ring oil bearings, on bedplate, with control gear.

450-h.p., 590-r.p.m. S/R, MATHER & PLATT, two pedestal ring oil bearings, on bedplate, double shaft extension with flexible couplings.

290-h.p., 750-r.p.m., synchronous induction BRUSH, two endshield ball/roller bearings, direct coupled exciter, 30 volts, 200 amps., with control gear.

260-h.p., 585-r.p.m. S/R, MATHER & PLATT, pipe ventilated, two endshield ball/roller bearings, with control gear.

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Note.—These engines are still packed in their original cases and have never been used. They are an exceptional bargain at £190 each. Limited number only. Immediate delivery.

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A HIGH-vacuum impregnation unit or single or batch coil impregnation service to RIC Specification 214 or individual requirements.—Blickvac, Hamilton Road Works, Hamilton Rd., London, S.E.27 (Tel. Gipsy Hill 4394). 44

A.C. and D.C. house service meters, all sizes, quarterly and prepayment, reconditioned, guaranteed one yr. Repairs and recalibrations.—The Victa Electrical Co., 47, Battersea High Street, S.W.11 (Tel. Battersea 0780). 138

A.C. and D.C. motors, all sizes, large stocks, fully guaranteed. — Milo Engineering Works, Milo Road, East Dulwich, S.E.22 (Forest Hill 2278-9). 102

A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5506/9). 91

A.C. and D.C. motors, new and reconditioned. Diesel alternator sets, generators, transformers, welders, plating equipment, switch and control gear, etc. Stock list post free.—Thos. W. Ward Ltd., Albion Works, Sheffield (Phone 26311, ext. 347). 248

ALTERNATOR control panel cubicles, 1,000 kW, 500 kW, 250 kW, 150 kW, 3-phase, 400 volts.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 23

ALTERNATORS, 2 to 30 kW, 1 and 3-ph., and D.C. generators, 300 w. to 24 kW. Lists.—Powerco Ltd., Wandsworth Town Station, York Road, London, S.W.18 (Vandyke 5234). 147

ALTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 330 kVA.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1 (CLErkenwell 5512). 24

ALTERNATORS, 27½ kVA, 400/3/50, 4-wire, by leading makers, excellent condition.—Box 6685.

BALLARD gas stoving oven, 6′ × 6′ × 3′6″, complete, also vacuum impregnating plant, 3′ 6″ dia. × 3′ 6″ deep, with reservoir pump, etc., complete.—Box 6687.

BARGAINS in electric motors are always being obtained from A. Cooksley & Co. Ltd., 21/25, Tabernacle Street, London, E.C.2. Stocks include A.C. and D.C. motors, secondhand and new up to 30 h.p. Starters, slide rails and pulleys. Ring Moon. 3355 for your requirements. 50

CIRCUIT breakers, various sizes in stock, A.C. and D.C., 200 amperes up to 2,000 amperes. Also dynamo and alternator switchboards.—Britannia Manufacturing Co. Ltd., 22 26, Britannia Walk, London, N.1. 26

CRANE motors. Direct current, series wound or compound wound, all voltages. We have large stocks. — Britannia Manufacturing Co. Ltd., 22/26 Britannia Walk, London N.1. 22

DIESEL generating sets, English manufacture, direct current, all voltages, all sizes to 500 kW.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1. 17

CIRCUIT breakers, 300 amps., 3-phase, 50 cycles, Crompton Parkinson clad type, floor mounting, 25 MVA rupturing capacity. Number available. — Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Tel. Clerkenwell 5512). 21

DIESEL generating sets, English manufacture, 3-phase, all sizes to 500 kW.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1. 16

ELECTRIC motors, dynamos, alternators and motor generator sets of all sizes. We hold one of the largest stocks in England. New and reconditioned, with 12 months' guarantee.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Clerkenwell 5512, 3 lines); also Works and Stores, Chobham, Surrey. 20

ELECTRIC motors, generators, control gear, transformers, A.C. and D.C., new and reconditioned; all covered with our usual 12 months' guarantee; large stocks available.—Electropower Co. Ltd., Kingsbury Wks., Kingsbury Rd., London, N.W.9 (Colindale 4621-2). 42

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ELECTRICIANS. Send for details Shaftesbury lightweight "Bantam" ladders. Top sections fitted with patent moulded rubber blocks, eliminate possibility of scratching or marking walls, fascias, and other painted or highly polished surfaces. Also available for immediate delivery, steps, platform steps, trestles, telescopic trestles, pole and builders-type ladders, and all sizes of two and three-section extension ladders.—Shaftesbury Ladders Ltd. (E. R.), 453, Katherine Road, London, E.7 (Phone: Grangewood 3363/4). 111

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FLUORESCENT fittings and control gear for home and export. Wide range competitively priced. Catalogues from — Rada, 148-150, Curtain Road, London, E.C.2 (Shoreditch 8275, 4 lines). 237

FLUORESCENT fittings, lamps, starters and control gear for home and export. Fully guaranteed by actual manufacturers. Send for catalogues. — The Anglo-American Electrical Company, Olive Street, Bury, Lancs. 245

FLUORESCENT tube renewal service. New guaranteed fluorescent tubes (to British standard specification) supplied at 7s. per 5-ft. tube and 6s. 4d. per 4-ft. tube against return of old used tubes.—Fluorescent Starters Ltd., Springfield Road, Guiseley, Leeds. 134

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FRACTIONAL h.p. motors, new, ex stock, A.C./D.C., Universal, B.T.H., Delco-Remy, G.E.C., Fracmo, Newman, Scophony. — Jeary Electrical Co. Ltd., 5, Lamb's Buildings, London, E.C.1. 126

GENERATING sets, petrol engine-driven alternators, 220/240 volts, single-phase and 3-phase. — Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1. 19

GENERATING sets, petrol engine-driven dynamos, 110 volts and 220-440 volts, direct current. — Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1. 18

HACKBRIDGE oil-immersed three-phase transformer, primary 11,000 volts, secondary 433/250 volts, capacity 750 kVA. Specification from—Whtiefield Machinery & Plant Limited, Cobden Street, Salford, 6 (Tel. Pen. 4746). 6571

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IMMEDIATE delivery new 330-kVA, 400-volt, 3-phase, 50-cycle, 4-wire B.T.H. alternator direct coupled to 400-h.p. Paxman diesel engine, 1,000 r.p.m., complete with switchboard and A.V.R. control.—C. J. Ferguson & Sons Ltd., 33, Barbican, London, E.C.1 (Monarch 5474/5). 104

LOW-tension slate panel switchboard fitted with circuit breaker, 2,000 amperes, ammeter, voltmeter, and isolator for use on 220 volts D.C. supply. Specification from—Whitefield Machinery & Plant Limited, Cobden Street, Salford, 6 (Tel. Pen. 4746). 6572

MERCURY switches are made by Hall, Drysdale & Co. Ltd., of 58, Commerce Road, Wood Green, London N.22 (Tel. Bow 7221). 182

METAFILTER oil filter machine, in new condition, for sale at low price.—Box 6684

MOTOR alternators, 2 kW, single-phase, 1,500 cycles, 2,500-r.p.m. alternator direct coupled 220-volt D.C. motor by Newton.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 28

MOTOR generator sets and converters, all sizes and voltages from ½ kW up to 500 kW in stock. — Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, City Road, London, N.1 (Tel. Clerkenwell 5512, 5513 & 5514). 12

MOTOR generator sets: switchboard; control panels; built to individual requirements. Competitive prices. Enquiries to—Thos. W. Ward Ltd., Albion Works, Sheffield (Phone 26311, ext. 347). 249

MOTORS. Large stock all types, reconditioned, at one half makers' price, ¼ to 300 h.p. Switchgear available.—J. S. Ramsbottom & Co. Ltd., Keighley (3744/5/6). 70

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ONE 500-kW B.T.H. rotary converter, 1,000 r.p.m., 440 volts, 1,135 amps., 3-wire, D.C. output. Self-synchronising starting motor complete with 550 kVA, 6,600/330-volt, 3-ph., 50-cycle transformer, A.C. switchgear, D.C. switchgear and starting panel. All in good working order and for disposal due to standardisation of equipment. Further details from Herbert Morris Limited, Loughborough. Chief Plant Engineer (Telephone, Loughborough 3123, Ext. 306). 6686

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PILOT motors, single to three-phase, various sizes up to 90 h.p. — Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 25

PLATING dynamos and motor generator sets, various sizes from 500 amps. up to 2,000 amps., with A.C. or D.C. motors.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 15

PLATING rectifiers (2), each 4,000 amps., 8 volt output, with 400-volt, 3-ph. transformers.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1. 6667

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PREPAYMENT 1s. slot house service meters. —Universal Electrical, 217-221, City Road, London, E.C.1. 36

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ROTARY converters in stock, all sizes; enquiries invited. — Universal Electrical, 221, City Road, London, E.C.1. 34

SMALL BA screws and nuts in steel, brass and stainless steel, from stock.—Premier Screw & Repetition Co. Ltd., Woodgate, Leicester. 180

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TRANSFORMER, 20 kVA, single-phase, 50 c., air-cooled open type, voltage ratio 100/220, as new. Offers.—Box 7785.

TRANSFORMERS all voltages up to 50 kVA. State requirements.—Powerco, Wandsworth Town Station, York Road, London, S.W.18 (VANdyke 5234). 148

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VENNER time switches, 200-240 v. A.C./D.C., 10-50 amps., from stock.—Universal Electrical Co., 221 City Rd., London E.C.1. 38

WARD Leonard motor generator sets, all sizes.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1 (Tel. Clerkenwell 5512). 10

WELDING dynamos and welding sets for sale.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1. 11

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WANTED, rotary converters, any sizes.—Universal, 221 City Rd. London E.C.1. 35

WANTED, surplus stocks cable, all types and sizes. We can inspect.—Box 220.

WANTED, 300/350-kVA alternator, 400 v., 3-phase, 50 cycles, 4-wire, 375 r.p.m.—John Godden (Stoke) Ltd., Kingsway, Stoke-on-Trent. 6728

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COMPANY MEETING

AERIALITE LIMITED

An Active and Thriving Business

THE 22nd Annual General Meeting of Aerialite Limited was held on 16th December at Stalybridge, Mr. L. S. Hargreaves (chairman and managing director) presiding.

The following is an extract from his circulated statement: In spite of the very keen competition on certain types of cable which we make, largely due to the uncertainty created in the business by the Monopoly Commission Report, I feel that the balance sheet which we have produced this year is a very satisfactory one indeed. You will recollect that last year I made a point that it was necessary to sell at very much lower prices now than it was previously. This company is fortunate in being able to sell its products at prices certainly no lower than its competitors. This is due to the excellent name these products have and the knowledge of our quality and reliability, but there are some manufacturers who are depressing prices on some types of cables below economic levels, and this is making it necessary for us to sell a certain volume of our business at very small profits indeed.

Our order book is generally healthy. We are doing increasing business with the electricity boards, the building trade, radio and television manufacturers, the motor trade, and many more architects and local authorities are specifying both "Ashton" rubber cables and our "Ashathene" polythene cables along with "Nettle" accessories.

Strong Demand for Products

We are taking steps by re-equipment of our plant to become more competitive and we feel when we have installed the plant which we have in mind, and which we shall have operating, we hope, in the early New Year, that we shall be in a better position still to meet competition from any quarter. The demand for our products is very strong and we have not been able to execute a large volume of business due to our sales exceeding our productive capacity, and this, I think, will mean that in the not too distant future we shall have to seriously consider some considerable extension to our activities if our customers' demands are to be satisfied.

The fact that prices have been reduced has, however, not affected our turnover. We have managed to maintain our turnover on smaller prices and smaller profits by increasing the volume, and as our balance sheet shows, our profits are about the same as last year, but I must warn that the price competition which we are experiencing at present on the cable side of our business will mean that profits from this section will tend to be lower, for the time being at any rate, until we see what effect the Monopoly Commission has in January on the industry as a whole.

On the television side the present demand is very healthy and is likely to increase wtih the advent of Band III Commercial Stations which open in September.

Our Nettle business has improved considerably and their profits are steadily rising due to the development of a number of exceptionally good products which are in strong demand.

Generally, I think we can say we have a picture of a very active and thriving business which taxes the management to keep up with the growing demand.

Trading Results

I think you will agree that we have produced a satisfactory picture again this year, and I hope that we can maintain the profit figures which we are showing at present, even if it might be difficult in the early future to increase them.

You will note that there is a profit before taxation on Aerialite Ltd. of £143,884 and a profit of £172,593 for the group as against £186,513 last year for the group. The Interim Dividend has already been declared and paid in May of 33⅓%, and your directors recommend a Final Dividend of 55%, which is the same as last year.

The report was adopted.

At a subsequent extraordinary general meeting the resolution approving the capital increase of one for one bonus issue was approved, the chairman making it clear that the scrip bonus would be unlikely to mean an increase in the overall payout. 8299

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HOW DOES one establish a footing in the ever-widening field of electrical contracting? More important—how does one become an efficient, well-organized contractor with a flourishing business and a reputation for good service.

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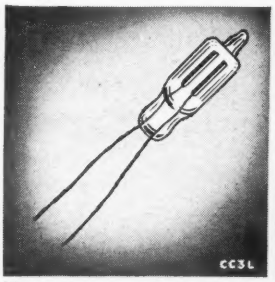

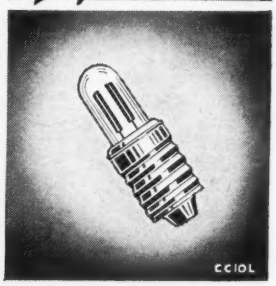

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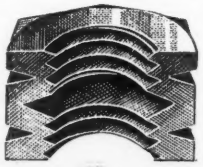

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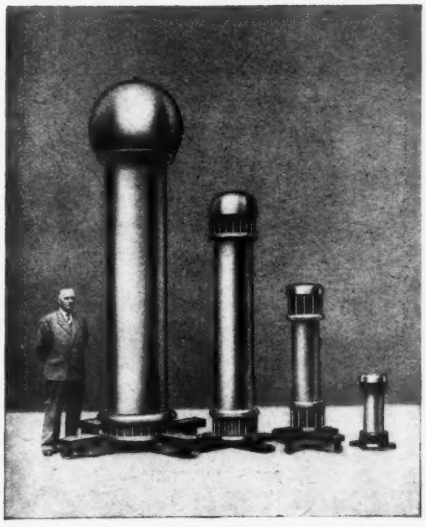

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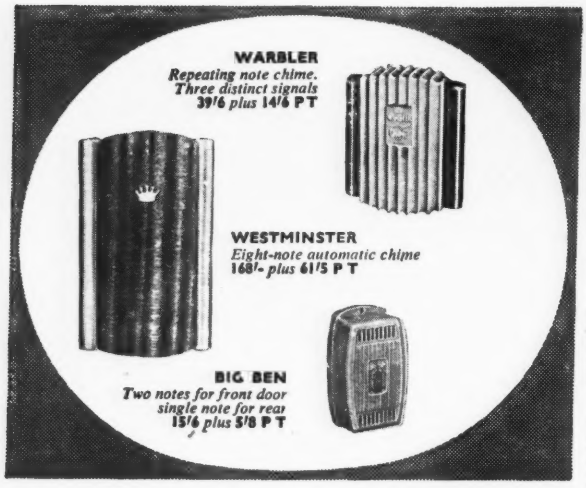

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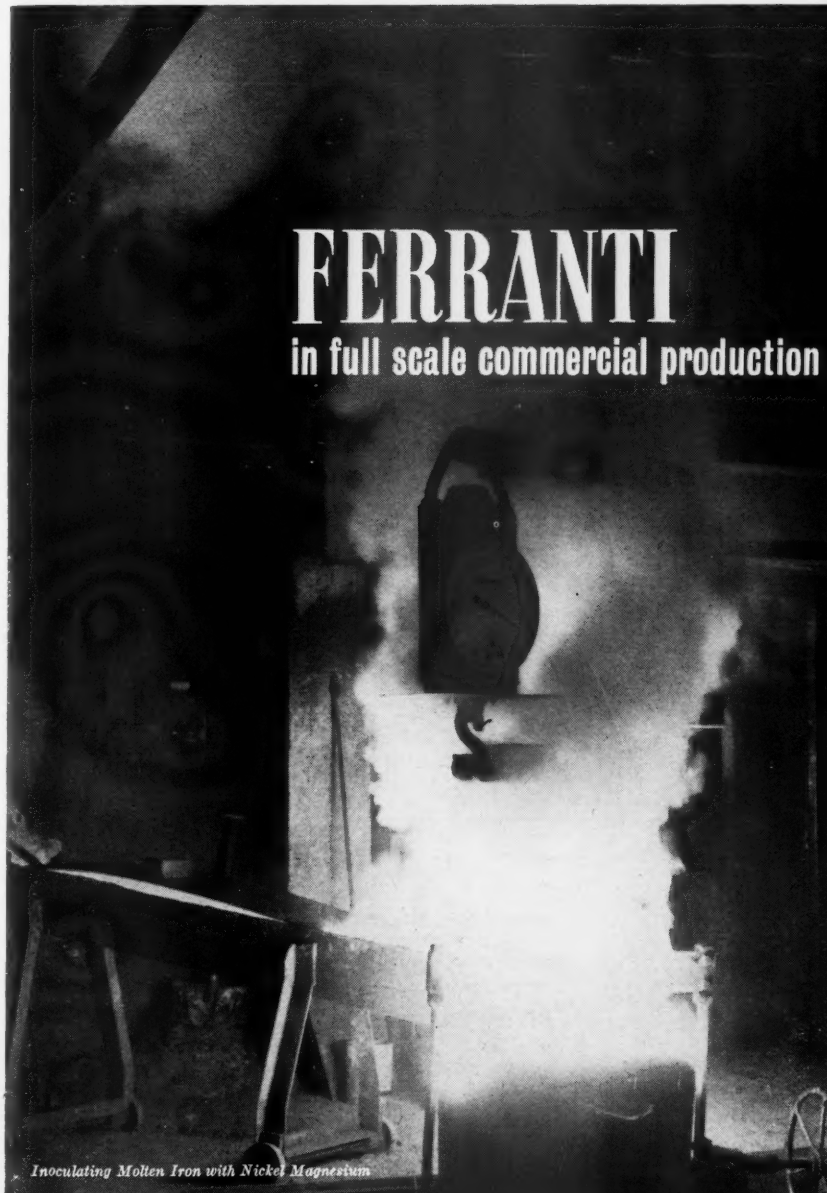

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INDEX TO ADVERTISERS

Abboflex Ltd. 104
Acru Electric Tool Mfg. Co. Ltd.... 38
Advance Components Ltd. 19
Aerialite Ltd. (Company Meeting).. 95
Agro Electrical Co. Ltd. 25
Aluminium Union Ltd. 40
Arcolectric Switches Ltd. 8
Ashley Accessories Ltd. 37
Austinlite Ltd. 84
Australian Post Office 96
Automatic Coil Winder & Electrical Equipment Co. Ltd. 1
Avis & Baggs Ltd. 85

Bakelite Ltd. ..... 47 & 56
B.B. Chemical Co. Ltd. 12
Berry's Electric Ltd. 64
Birch, H. A., & Co. Ltd. 6
Birmingham Mica Co. Ltd. 82
Birmingham Specialities Ltd. 32
Brentford Transformers Ltd. 35
Bridge, David, & Co. Ltd. 8
British Electrical Repairs Ltd. 26
British Electricity Authority 42
British Insulated Callender's Cables Ltd. 75
British Thomson-Houston Co. Ltd. 5
Brush Electrical Engineering Co. Ltd. 45
Bryce Electric Construction Co. Ltd. 30
Bullers Ltd. 67
Burgess Products Co. Ltd. 71

Cable Makers Association 44
Cambridge Instrument Co. Ltd. ... 64
Carter, H. W., & James Ltd. 85
Casey, C. T. (London) Ltd. 32
Cayson Electrics Ltd. 74
Chloride Batteries Ltd. 79
City Electrical Co. 104
Clang Ltd. 86
Concordia Electric Wire & Cable Co. Ltd. 98
Connollys (Blackley) Ltd. 22
Controlled Heating Units (London) Ltd. 20
Copper Development Association ... 36
Crabtree, J. A., & Co. Ltd. 43
Cressall Mfg. Co. Ltd. 54
Critchley Bros. Ltd. 100
Crofts (Engineers) Ltd. 55
Crompton Parkinson Ltd. 27
Crosslands (Rugeley) Ltd. 52
Cryselco Ltd. 49

Daly (Condensers) Ltd. 51
Davey, W. C., & Co. 81
Davu Wires & Cables 104
Dennis, G. P., Ltd. 58
Donovan Electrical Co. Ltd. 102
Dorman & Smith Ltd. 60

East London Mica Works 69
Edison Swan Electric Co. Ltd. Cover 2 & 76
Elcontrol Ltd. 25
Elcordia Ltd. 52
Electrical Industries Benevolent Association 98
Ellison, George, Ltd. ..... Cover 1
Eltron (London) Ltd. 82
Engineering & Lighting Equipment Co. Ltd. 28
Ensel Electric Co. Ltd. 31
Enthoven Solders Ltd. 21
Erskine, Heap & Co. Ltd. 50

Ferguson Pailin Ltd. 57
Ferranti Ltd. ..... 11 & 101
Foster Transformers Ltd. 83
Friedland, V. & E., Ltd. 100
Fry's Metal Foundries Ltd. 13

General Electric Co. Ltd. ... Cover 4 & 88
Gosheron, John, & Co. Ltd. 78
Grelco Ltd. 12

Hampton Works (Stampings) Ltd. 81
Hedin Ltd. 56
Henley, Burrowes & Co. 12
Henley's, W. T., Telegraph Works Co. Ltd. 17
Hivac Ltd. 96

Ilford Ltd. 3

Jacobsen, J. A. B., Ltd. 86
Jelson Electric Ltd. 100
Johnson & Phillips Ltd. 87
Jones, Stroud & Co. Ltd. 2

Kandem Electrical Ltd. 99
Kirkstall Forge Engineering Ltd. ... 25

Legg (Industries) Ltd. 65
Lewis Spring Co. Ltd. 32
Litholite Insulators & St. Albans Mouldings Ltd. 20
Londex Ltd. 52
London Transformer Products Ltd. 80
Lumitron Ltd. 59

Mackley, E. N., & Co. 33
Magnetic Devices Ltd. 78
Martindale Electric Co. Ltd. 65
Mather & Platt Ltd. 41
M. & C. Switchgear Ltd. 53
Mek-Elek Engineering Ltd. 99
Mercury Switch Manfg. Co. Ltd. ... 46
Meritus (Barnet) Ltd. 56
Metropolitan-Vickers Electrical Co. Ltd. 18
Metway Electrical Industries Ltd. 16, 85 & 104
Midland Coil Winding Co. Ltd. 100
Midland Electric Manufacturing Co. Ltd. 4
M.K. Electric Ltd. 62
Mole, M., & Son Ltd. 45
Morgan Crucible Co. Ltd. 39
Morley's Electrical Services (Holloway) Ltd. 86
Murchie Trading Co. Ltd. 46

Nettle Accessories Ltd. 81
New Day Elec. Accessories Ltd. ... 38
Newman Industries Ltd. 95
Non-Ferrous Die Casting Co. Ltd.... 60
Normand Electrical Co. Ltd. 24
Nuts & Bolts (Darlaston) Ltd. 98

Oddie, Bradbury & Cull Ltd. 26
Otter Controls Ltd. 85
Ottermill Switchgear Ltd. 68

Parmiter, Hope & Sugden Ltd. 103
Parnall (Yate) Ltd. 10
Parsonage, W. F., & Co. Ltd. 38
Partridge Wilson & Co. Ltd. 61
Peterborough Die Casting & Machine Co. Ltd. 31
Pinchin Johnson & Co. 97
Pioneer Oilsealing & Moulding Co. Ltd. 95
Pirelli-General Cable Works Ltd. ... 14
Pitman, Sir Isaac, & Sons Ltd. ... 55
Portable Furnace & Patents Co. 74
Presspahn Ltd. 26

Radiovisor Parent Ltd. 72
Reyrolle, A., & Co. Ltd. 34
Rheostatic Co. Ltd. 73
Ritherdon & Co. Ltd. 97
Robinson, Lionel, & Co. Ltd. 12
Rowlands Electrical Accessories Ltd. 55
Runbaken Electrical Products 38

Santon Ltd. 32
Scholes, George H., & Co. Ltd... Cover 3
Scott, Hugh J., & Co. (Belfast) Ltd. 15
Service Electric Co. Ltd. 104
Sew-Tric Ltd. 31
Sims, F. D., Ltd. 69
St. Helens Cable & Rubber Co. Ltd. 66
Standard Telephones & Cables Ltd. 48
Stewart Transformers Ltd. 59
Sturdy Electric Co. Ltd. 20
Sturtevant Engineering Co. Ltd. ... 7
Sunvic Controls Ltd. 77

Thew, Edward H., Ltd. 59
Transformer & Electrical Co. Ltd.... 74
Turners Asbestos Cement Co. Ltd... 23

Universal Electrical Co. 86

Vandervelde, L., Ltd. 26
Vaughan Crane Co. Ltd. 46
Veritys Ltd. 9
Vernier Manufacturing Co. Ltd. ... 19
Volex Electrical Products Ltd. 70

Wandleside Cable Works Ltd. 59
Ward, Thos. W., Ltd. 51
Ward & Goldstone Ltd. 29
Washers Ltd. 82
Weekes, L. (Luton) Ltd. 56
Weir Electrical Instrument Co. Ltd. 31
Westminster Eng. Co. Ltd. 16
Wheeler, F. H., & Co. Ltd. 16
Whitecross Co. Ltd. 72
Whitehead Chemical Co. (Waxes) Ltd. 82
Wootton & Co. Ltd. 74

Zenith Electric Co. Ltd. 16

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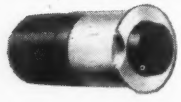

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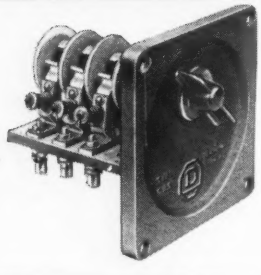

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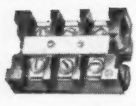

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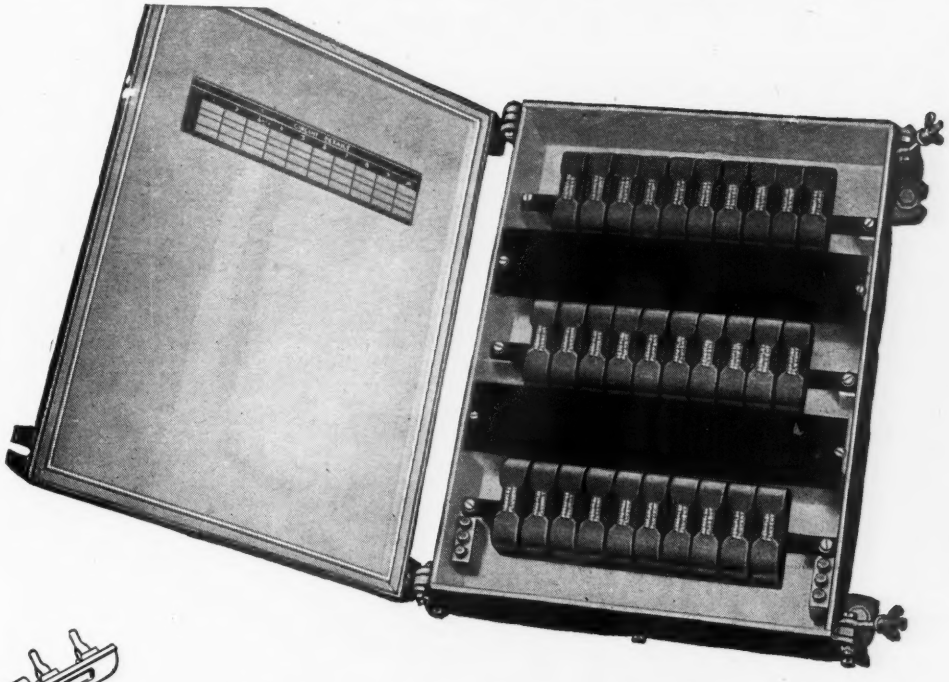

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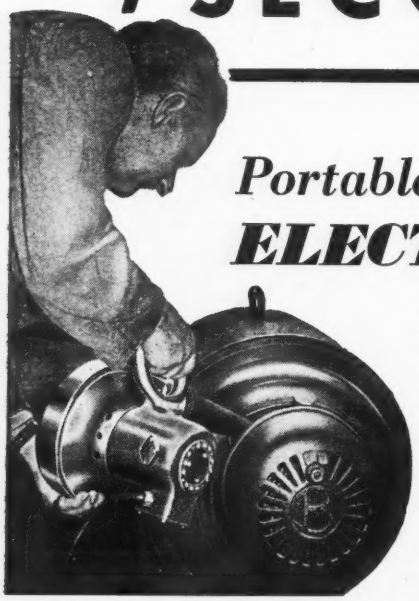

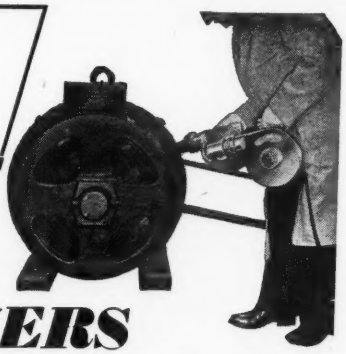

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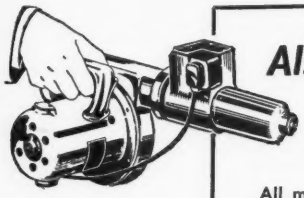

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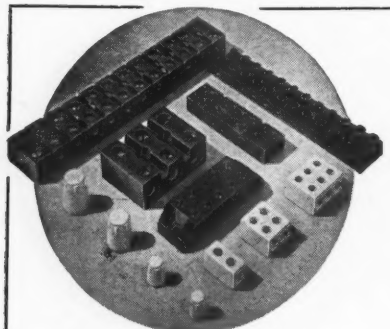

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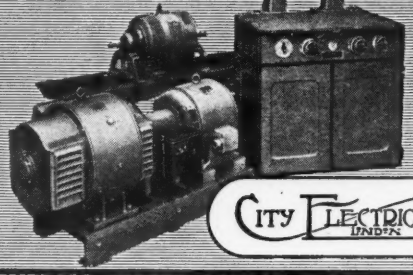

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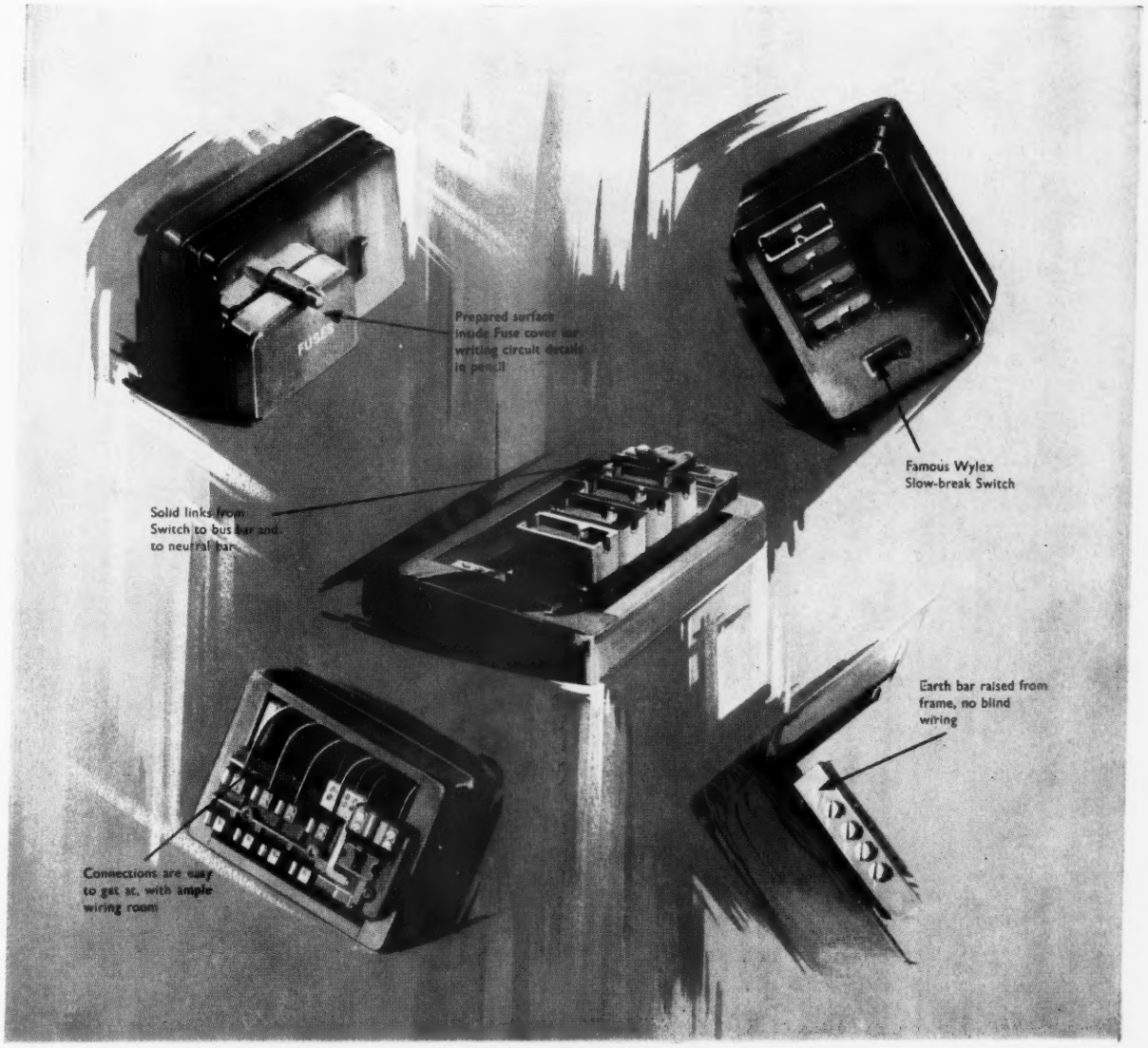
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